Prof E. D. Cope
Haddonfield
New Jersey.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XIII. JUNE TO DECEMBER, 1873. No. 91.

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Stated Meeting, June 20th, 1873.

Present, 13 members.

Vice-President, Mr. FRALEY, in the Chair.

Letters accepting membership were received from Sir Wm. Thompson, dated 35 Wimpole St., W. London, May 8th, 1873; Mr. P. L. Sclater, dated Zoological Society, London, May 20th, 1873: Prof. Giovanni Capellini, dated Museo di Geologia, Bologna, May 20th, 1873; Prof. Luigi Palmieri, dated Direzione dell, Osservatorio Vesuviano, Naples, May 12th, 1873; and J. B. De Rossi, dated Rome, May 10th, 1873.

Letters acknowledging the receipt of the Society's Publications were received from the R. Society at Edinburgh, March 18th, (XIV, i, ii, iii, 83 to 86,); Dr. F. Flügel, Leipsig, November 1, 1872 (85, 87,); the Natural History Society at Emden, October 1, 1872 (86, 87,); the Imp. Acad. at Vienna, October 4th, 1872 (XIV, iii, 87, ; P. Tunner, Leoben, September 20th, 1872 (87); Dr. Rokitansky, Vienna, October 12th, 1872 (87).

Letters of envoy were received from the Society at Erlangen, May 2d, and the Society at Batavia, January 20th, 1871, and December 30th, 1871.

A letter from the Grosvenor Library, Buffalo, New York, dated May 31st, 1873, respecting publications, was referred to the Library Committee, with power to take order.

Dr. Horn offered for publication in the Proceedings a paper entitled "A Synopsis of the Histeridae of the United States," with one octavo plate, and gave a verbal description of the paper, as one of the series bringing up the Natural History of the family to the present date. On motion of Dr. LeConte it was referred to the Secretaries, with power to furnish the required plate.

Mr. Lesley described a map of the Western Outcrop of the East Kentucky Coal Field, from the surveys of Mr. Joseph Lesley, assistant on the State Survey in 1858 and 1859, and offered it for publication in the Proceedings. On motion

of Prof. Frazer, it was referred to the Secretaries, with power to act; the expense to the Society not to exceed fifty dollars.

Dr. LeConte communicated a paper by Mr. Augustus Findler, comprising 24 propositions on Gravitation, being a summary of the author's unpublished work on that subject. On motion, it was referred to the Secretaries.

Pending nomination No. 733 was read.

On motion, the request of Prof Cope was granted, to withdraw from the printed Proceedings his paper on the Mammalia Educabilia. And the meeting was adjourned.

Stated Meeting, July 18th, 1873.

Present, 2 members.

, in the Chair.

A letter accepting membership was received from M. Edm. de Selys Longchamps, dated Liège, June 24th, 1873.

Letters acknowledging the receipt of the Society's publications were received from the Leeds Literary and Philosophical Society, June 11th, 1873, (87, 89, wanting 88); the R. Cornwall P. S., September; 22d, 1872 (Proc. for 1870); S. of Antiquaries, London, June 16th, (89); R. Academy, Amsterdam, July 3d, 1872 (86); C. P. Obs., St. Petersburg, November 12th, 1872 (XIV, iii); the Society at Freiburg, March 10th, 1873 (86, 87); and the Society at Riga, November 1st, 1872 (T. VIII; Proc. XIV; 12, 3).

Letters of envoy were received from the Society at Riga, November 1st, 1872; the Entomological Society at Brussels, February 4th, 1873 (requesting exchanges); the R. Acad. Amsterdam, November 6th, 1872; R. Acad., Lisbon, March 25th, 1873; the P. and L. Society at Liverpool, April 9th; U. S. Naval Observatory, June 23d, 1873; and Mr. Richard Vaux, of Philadelphia, June 14th, 1873.

Donations for the Library were received from the Societies at Batavia, Moscow, Riga, Freiburg i B., Bremen, Görlitz, Emden, Erlangen, Liverpool, Providence, Buffalo, Savannah, St. Louis and San Francisco. From the Imp. and Royal Societies at St. Petersburg, Copenhagen, Vienna, Leipsig, Brussels, Amsterdam, Lisbon, Edinburg and Tasmania. From Dr. Von Frauenfeld, of Vienna, M. Barrande of Prag, Dr. C. G. Giebel of Berlin, M. L. Gruner of Paris, the French Geographical Society, Belgian Entomological Society, Royal Institution, British Association, R. Astronomical, Asiatic, Geographical, Chemical, Zoological and Antiquarian Societies. From London Nature, the Massachusetts Historical Society, American Academy at Boston, Yale College, Silliman's Journal, Prof. Roehrig, the Franklin Institute, College of Pharmacy, Medical Journal, American Chemist, Penn Monthly, Dr. Geo. W. Morris, Mr. Henry C. Carey, Richard Vaux, Prof. E. D. Cope, Prof. S. S. Haldeman, the Smithsonian Institution, Census Bureau, U. S. Naval Observatory, and the Peabody Institute of Baltimore.

A notification of the publication of Mr. Grote's papers, by the Buffalo Society of Natural Sciences, was received, dated July 2d, 1873.

A circular from the Zoological Society of Philadelphia, dated May 1st, 1873, with a map of the proposed gardens in the Park, was received.

And the meeting was adjourned.

Stated Meeting, August 15th, 1873.

Present, 1 member,

Mr. P. E. Chase.

Stated Meeting, September 19th, 1873

Present, 17 members.

Vice-President, Mr. FRALEY, in the Chair.

Letters accepting membership were received from Dr. Hermann Helmholtz, dated Berlin, June 8th, 1873, and M. G. Gougain, dated St. Martin des Entreès, par Bayeux, Calvados, France, July 14th, 1873.

Letters acknowledging the receipt of publications were received from the Hungarian Academy, July 25th (XIV, iii, 87); R. Academia dei Lincei, Rome, January 7th (XIV, iii, 87); the Literary and Philosophical Society, Liverpool, August 21st (89); Harvard College, July 24th (90); New York Historical Society, July 24th (70); Maryland Historical September 16th (90); and Postal Cards of acknowledg ment for No. 90 of the Proceedings from eighty-six members and corresponding societies.

A letter requesting the completion of sets of the Transactions and Proceedings, was received from the Royal Institution in Liverpool, dated August 21st, 1873. On motion, the Librarian was authorized to forward the required publications to Mr. Alfred Morgan, Honorary Librarian of the Institute.

A medal was received from the University of Norway bearing the legend Regni Norvegici Annum Millesimum pia celebrat Universitas Regia Fredericiana; and on the reverse, Tempori Superstes, MDCCCLXXII.

Letters of envoy were received from the R. Geographical Society at Vienna, and from the Norway University

Donations for the Library were announced from the Russian, Prussian, Hungarian and Belgian Academies, the Geographical Societies at Vienna and Paris, the University of Norway, the Vaudoise Society, the Ecole des Mines, Revue Politique, and MM. C. H. Girard and Theo. Wechniakoff of Paris, the London Meteorological Society, Essex Institute, Am. Antiquarian Society, Silliman's Journal, Mr. Verplanck Colvin, Franklin Institute, Journal of Pharmacy, Medical

News, American Chemist and Penn Monthly, the U. S. Secretary of the Interior, the U. S. Surgeon General of the Navy, the Georgia Historical Society, and the Chicago Public Library.

The death of a member, Mr. Elias Durand, at Philadelphia, on the 14th of August, aged 79, was announced by the Secretary, and, on motion, Dr. Carson was appointed to prepare an obituary notice of the deceased.

The death of another member, Mr. William Morris Meredith, at Philadelphia, August 21st, aged 74, was announced by Mr. Fraley, and, on motion, Chief Justice Read was appointed to prepare an obituary notice of the deceased.

Dr. Genth offered for publication in the Proceedings, a paper containing the results of his investigations into the nature and extent of the changes exhibited by pseudomorphis after corundum, which he described, exhibiting typical specimens from the Mineralogical Cabinet of the University of Pennsylvania.

Dr. Horn presented a paper for the Proceedings entitled "Contributions to a Knowledge of the Curculionidae of the United States.

Prof. Frazer adduced facts which he supposed to be confirmatory of Prof. Tyndall's explanation of the blueness of the sky, and gave his own explanation why the moon's disc looks white by day and yellowish after twilight.

Prof. Houston thought that an objection to Tyndall's hypothesis might be found in the greater intensity of the lavender-colored rays.

Mr. Blodgett described the hot season preceding the hurricane of the 18th of August, and showed that the country between the Alleghany mountain and the sea had been slowly invaded from the south, by a mass of saturated tropical air, which finally reached the eastward-moving air of the west and north, and that the storm, which produced such terrible disasters from New York to Labrador, was the consequence.

Mr. Rand testified to the very local character of the ab-

normal rainfalls of August which wrecked the Chesapeake and Delaware canal banks, and other public works.

Pending nominations, Nos. 733 and 736, and new nominations Nos. 737, 738, 739 were read.

And the meeting was adjourned.

Stated Meeting, October 2d, 1873.

Present, 13 members.

Vice-President, Mr. FRALEY, in the Chair.

Letters acknowledging the receipt of Proceedings were received from the Glasgow Philosophical Society, Sept. 1st, 1873, and Yale College, Sept. 22, 1873 (90).

A letter of envoy was received from M. de Koninck, dated Liège, Sept. 11, 1873.

Donations for the Library were received from the Meteorological Committee of the Royal Society, London, the Essex Institute, the Penn Monthly, and the American Chemist.

Dr. Carson, on the part of Mrs. Jackson, widow of Dr. Samuel Jackson, presented to the Society the original diploma of membership in this Society, given to David Jackson, M. B., of Philadelphia, dated February 4th, 1792, and signed by David Rittenhouse, President; John Ewing, Thomas Jefferson, William Smith, Vice-Presidents; James Hutchinson, Rob. Patterson, Sam. Magaw, and John Williams, Secretaries.

Proofs of the map made by Mr. Bien, of New York, to illustrate Dr. Gabb's Memoir in the Transactions, entitled "Topography and Geology of Santo Domingo," were exhibited.

Prof. Chase offered for the inspection of the members a triangular MS. volume of mystical characters and of considerable age, and described its peculiarities.

Prof. Chase gave the historical development of Bode's, Pierce's and Kirkwood's Astronomical Laws, and compared them with his own harmonic analogy of the solar system.

Pending nominations, Nos. 733, 736, 737, 738, 739, were read.

On motion of Dr. Carson, the Publication Committee was authorized to publish Dr. Gabb's map in duplicate, colored and uncolored.

And the meeting was adjourned.

Stated Meeting, October 17th, 1873.

Present, 12 members.

Dr. Carson, in the Chair.

Letters acknowledging the reception of publications were received from the Royal Society, dated London, August 26, 1873 (89); the Linnean Society, August 20, 1873 (89; wanting 88 and XIV, ii); and the Lyceum of Natural History in New York, dated October 6, 1873 (90).

A letter of envoy was received from the New York State Library, at Albany, dated October 2, 1873.

A letter requesting the completion of its series of the A. P. S. Trans. and Proc. was received from the Director of the U. S. Naval Observatory, dated Washington, October 3, 1873.

A letter was received from Mr. F. W. Cristern, foreign bookseller, 77 University Place, New York city, transmitting a request from M. Germer-Baillière, editor of the Cours Scientifiques, published in Paris. On motion, the request was granted.

Donations for the Library were received from the Ecole des Mines, Revue Politique, London Nature, Royal Society, Linnean Society, Mr. Edmund Quincy, Silliman's Journal, New York State Library, Regents of the University of New

York, Dudley University, Franklin Institute, College of Pharmacy, Journal of the Medical Sciences, and the Bureau of the Interior.

Prof. Trego described his recent observations on the iron ore deposits of Buckingham Mountain, east of Doylestown, in Bucks Co., Pa., when the lower Silurian limestones and Potsdam sandstone appear at the surface through the covering of the New Red, and bring up their characteristic brown hematites.

Mr. Lesley remarked that this exhibition of the ores was of special importance in refutation of the old opinion that, in the back valleys of Middle Pennsylvania, they originated from the erosion of the ferruginous layers of No. IV Middle Silurian, the nearest outcrop of which is forty miles to the north of Doylestown. The iron is undoubtedly a constituent of the Lower Silurian sand-lime deposits, and the ore-beds are co-extensive with the outcrops of the latter. Another important aspect of the exhibition at Doylestown is evident by comparison of it with the emergence of the Potsdam and Calciferous and Trenton formations, carrying the same ores at Chiquesalunga, on the Susquehanna river, ninety miles west of Doylestown, and on the southern edge of the New Red area. In coming times, the iron masters of Pennsylvania will moot the question of the possibility of reaching these ores under the covering of New Red, just as the English coal operators are at present engaged in discussing the attainability of the Coal Measures, under their New Red areas.

Prof. Houston spoke of the possible, or rather necessarily certain influence of the heat-radiation of the full moon, penetrating as it does the upper fourth or third of the earth's atmosphere, upon climate, and the duty of meteorologists to take account of it in their theory of storms. He inquired if any of the members present had noted a concurrence of low barometer and full moon, or any tendency in winds to move towards the district underlying a full moon. Putting together the two facts of a highly-heated moon surface with-

out atmosphere, and the negative appreciation of said heat by the thermo-electric pile at the bottom of the earth's atmosphere, it seems a necessary consequence that a complete absorption of the lunar-heat radiation must take place in the aqueous vapor of the upper strata of the earth's atmosphere, and this should produce visible effects in meteorology.

Prof. Frazer suggested that these effects should be *in maximo* in winter, or after long cold spells of weather.

Mr. Goodfellow gave it as his experience, in observing for the Coast Survey, that during the full of the moon he was always pretty sure of having a good clear night for observation, if only the common wind-clouds obscured the sky in the early evening; but not when rain-clouds were floating in the atmosphere.

Dr. Emerson said that many years ago he took the position, and had seen no good reason for abandoning it, that apart from gravitation the moon exerted no influence whatever upon the wet and dry changes of the atmosphere.

Pending nominations, Nos. 733, 736, 737, 738, 739, were read and spoken to, and then balloted for. There being no further business, the ballot-boxes were examined and the following gentlemen were declared duly elected members of Society:

Mr. A. Loudon Snowden, Chief Coiner of the U. S. Mint.
Mr. John S. Haines, of Germantown.
Mr. Matthew Huizinga Messchert, of Philadelphia.
Mr. J. Blodgett Britton, of Philadelphia.
Mr. John W. Harden, M. E., of Philadelphia.

Mr. Price submitted the following resolution, which was adopted:

Resolved, That the Treasurer be directed to pay to Henry M. Phillips, Treasurer of the Fairmount Commissioners, such a sum as, with $300 before so paid, shall be equal to half the income of the Michaux Legacy.

And the meeting was adjourned.

Stated Meeting, November 7th, 1873.

Present, 7 members.

Dr. COATES in the Chair.

Letters accepting membership were received from M. Henri de Saussure, dated Genève, October 15, 1873; Mr. M. H. Messchert, dated Douglassville, Berks Co., Pa., October 20, 1873; Mr. J. Blodgett Britton, dated 339 Walnut street, Philadelphia, November 1, 1873; and Mr. A. Loudon Snowden, dated U. S. Mint, Philadelphia, October 22, 1873.

A letter from Mr. George A. Belcourt, prêtre, was read, dated Memramcook, New Brunswick, Canada, October 24, 1873, renewing his correspondence relating to the publication of his Indian Dictionary, the publication of which in the Imperial Printing House at Paris, was stopped by the fall of Napoleon III at Sedan.

Letters of acknowledgment were received from the Belgian Academy, dated Brussels, October 7, July 11, and September 16, 1872, and April 25, 1873 (XIV, i, iii, 85, 86, 86, 87); and the McGill University, dated Montreal, October 14, 1873.

Letters of envoy were received from the Belgian Academy, May 10th, 1873, and the Bureau of Statistics, dated Stockholm, July 7, 1873.

Donations for the Library were received from the Academies of Science at St. Petersburg, Berlin, Copenhagen, Bologna, Rome and Salem; the Institutes at Venice and Milan; the Societies at Moscow, Königsberg, Frankfort, Nüremberg, Lausanne, Geneva, Lyons, Bordeaux, Liège, Copenhagen, Falmouth and Montreal, the Geological Institute at Vienna, Geological Committee at Florence; Geological Societies at London and Glasgow; the Geographical and Anthropological Societies at Paris; the London Geographical, Chemical, Zoological and Antiquarian Societies; the Society of Northern Antiquaries at Copenhagen; the Bureau of Statistics at Stockholm; the Observatory at Brussels; London Na-

ture; the Revue Politique; M. Delesse at Paris, Sig. Capellini at Bologna; M. Rütimeyer at Basil; Dr. Siedenblod at Stockholm; M. Mailly at Bruxelles; the Boston Public Library; Silliman's Journal; the American Chemist; Medical News; Journal of Pharmacy, Penn Monthly and Prof. E. D. Cope, at Philadelphia.

The deaths of two members were announced by the Secretary:

Sir Henry Holland, at London, October 28th, aged 85.

Joseph Saxton, at Washington, October 26th, 1873.

Copies of the First Part of the Society's Transactions, Vol. XV, were laid on the table for inspection, before distribution.

The Secretary read a communication from a friend recently returned from the West, entitled "An Acoustic Phenomenon of the Rocky Mountains."

And the meeting was adjourned.

Stated Meeting, November 21st, 1873.

Present, 11 members.

Vice-President, Mr. FRALEY, in the Chair.

Letters of acknowledgment were received from the Egyptian Institute, dated Alexandria, June 9, 1873;—the Vaterlandische Verein, dated Würtemberg, June 15 (78–80, 82–88), requesting the completion of their set of Proceedings A. P. S. and also Transactions, and promising a full suit of the V. V. publications (on motion, referred to the Publication Committee);—the Schweizerishe Gesellschaft, dated Bonn, 1873 (88); and the Royal Observatory, at Prague, May 9, 1873 (XIV, iii 87).

Letters of envoy were received from the Batavian Society

of Arts, Batavia, November 4, 1872, and the Swiss Society at Bonn.

A letter from the State Historical Society of Wisconsin, dated Madison, November 11, 1873, offering to supply the Library of this Society with State Documents published in the last ten years, and with its own catalogue, was read.

Donations to the Library were announced as received from the Societies at Moscow, Fribourg, Batavia, Nijmegen, and Buffalo; the Chemical, Geological and Antiquarian Societies in London; British Association; London Nature; Radcliffe Observatory; Rev. Samuel Houghton; New York Historical Society; Philadelphia Academy of Natural Sciences, Franklin Institute, American Chemist, and Mr. Eli K. Price

A communication from Prof. Daniel Kirkwood was read, dated Bloomington, Indiana, October 23, 1873, and entitled "The Meteors of January 2d."

Dr. LeConte called the attention of the members present to the report of strange noises in the Rocky Mountains, made in the Journal of Lewis and Clarke, apropos of the communication read at the last meeting.

Mr. Joshua Lyman, of Lenox, Mass., exhibited his improved table-instruments for plotting and draughting with equal accuracy the most accurate field-work of civil engineers. The admiration of experts present was freely expressed.

On motion of Mr. Briggs, Mr. Hilgard, of the Coast Survey, was appointed to prepare an obituary notice of the late Joseph Saxton.

The minutes of the last meeting of the Board of Officers was read.

And the meeting was adjourned.

Stated Meeting, December 5th, 1873.

Present, 13 members.

Vice-President, Mr. FRALEY, in the Chair.

A letter acknowledging diploma was received from Prof. Jean Baptiste de Rossi, dated Rome, November 6, 1873.

A circular letter was received from Dr. Leopold Just, dated Carlsruhe in Baden, requesting botanists to forward their memoirs published in 1873, for notice in the Botanischer Jahresbericht.

Donations for the Library were announced from the Royal Prussian Academy, the Geographical Society and Revue Politique at Paris; London Nature; the Royal Astronomical Society; the Chief of the Observatory in the Mauritius; Yale College; Prof. F. B. Hough, of Lowville, N. Y.; the Medical News and Library, Penn Monthly; Dr. Newberry, State Geologist of Ohio; Prof. Worthen, State Geologist of Illinois; and Col. C. G. Forshey, of New Orleans.

The decease of Prof. F. L. Georg von Raumer, at Berlin, June 14, 1873, aged 92, was reported by the Secretary.

Dr. Brinton communicated a vocabulary of the Natchez dialect of the Creek language spoken generally by the tribes of the Gulf States, which he had recently obtained and investigated, including in it the original short vocabularies of Mr. Gallatin and Mr. Duponceau.

The Annual Reports of the Treasurer and Publication Committee were read.

Pending nominations, No. 740 was read.

Dr. LeConte obtained permission to borrow from the Cabinet of the Society, a few small articles of Mexican pottery, under the charge of the Curators.

And the meeting was adjourned.

THE OUTCROP BELT OF THE EAST KENTUCKY COAL FIELD.

(*To accompany a Map presented to the American Philosophical Society, June 20th*, 1873.)

By Joseph Lesley,

Late Assistant on the Kentucky Geological Survey.

Under appointment of David Dale Owen, State Geologist of Kentucky, I began, on the 25th of August, 1858, a Geological and Topographical Survey of the margin of the Eastern Coal Field of the State, to determine its area, and the number, thickness and attitude of its beds of coal and iron ore; and to get a reliable base for a future survey of the whole Eastern Coal Field, as far as to the Virginia line.

The base line of my survey was run upon the common roads of the country; flying side lines, and in some cases closed looped lines, being carried out sideways to the western outcrops wherever necessary.

An admirably constructed odometer was used for measuring distances, and a compass with side-telescope and eccentric target for running courses. Aneroid observations, regularly taken at every station, were checked by clinometric measurements made with a vertical circle attached to the telescope; and also by synchronous observations with a barometer stationary in camp.

The main base line was also carefully leveled for a distance of about two hundred miles with a spirit-level, which was also used on some of the side lines, in order to tie the parts of the work together, and to give the exact datum above tide-water for all principal stations, in view of adopting them as starting points of the contemplated survey of the whole coal field.

The work thus described was continued from September 1, 1858, to November 1, 1859, seven months being passed in field work, and with the following results:

1st. A large contour-line map was made on a scale of three miles to the inch, which has never been published. The original plottings were on a scale of five hundred feet to the inch. This map includes only the ground covered by the survey, and shows the positions of towns, county-line crossings, coal openings and other points of interest, as well as the crossing of the long east and west base line run by S. S. Lyon, Assistant on the State Geological Survey.

2d. The map now published for the first time, to accompany this description, was compiled from the survey sheets of the first-named map, from old maps in the Internal Improvement Office, from railway surveys, and from the old State map.

3d. A base line for future use, extending in a general southwest direction along the strike of the formations, beginning at a point five hundred and ninety-seven feet above tide, close by the town of Grayson, in Carter

county, Northeast Kentucky, and extending, by a loop embracing a section covered by the Little Sandy River and its tributaries, to the ridge dividing Carter from Rowan counties; thence, across the east end of Bath county to Jeffersonville, in Montgomery County; thence, to the Red River Iron Works on the edge of Estill county; thence, to the town of Proctor and its coal mines on the Kentucky River; thence, across Owsley county to McKee in Jackson county; thence, to Mt. Vernon in Rock Castle county, and Somerset in Pulaski county; thence, across the Cumberland River at the "lower ford" to Monticello in Wayne county; and thence, to its southern terminus on the Tennessee State-line in Clinton county, at a point on the waters of Wolf River, one thousand and nineteen feet above tide.

4th. The establishment of sixty-two bench marks, showing elevation above tide and above low water in the Ohio River at Catlettsburg.

5th. An unpublished geological section to accompany Map No. 1.

By observations made during the progress of the work, the following points of scientific interest present themselves:

1st. In approaching this coal field from Middle Kentucky, over the lower Silurian formations, one is confronted by a belt of cone-shaped hills having the Devonian black slates in their gently sloping bases, upon which rise steeper slopes of the olive-colored shales and overlying grit stones of the same system. These shales and grit stones together vary in thickness from three hundred and fifty to five hundred and fifty feet, the lower and larger division of the formation having disseminated through it nodular masses of earthy iron ore, giving origin to numerous chalybeate springs; the upper division affording valuable building stone.

Upon the above-named rocks lies the Mountain or Sub-carboniferous Limestone, varying in thickness from seventy feet at the north end of the line to four hundred feet and more at the southern end. This formation is composed of alternating layers of white, gray and buff-colored strata, ranging in quality from argillaceous claystone to the purest plaster limestone. The lowest members of the series hold large dark green flint pebbles, and exhibit traces of galena. Dry valleys and numerous caves distinguish this formation.

Above these limestones lies the Millstone Grit formation (the Conglomerate No. XII of the Pennsylvania Survey) in two members; the lower made up of thin sandstones and shales, enclosing beds of coal and iron ore. This is named the "Sub-conglomerate" member. The upper or "conglomerate" proper consists of a massive, coarse-grained ferruginous sandrock containing pebbles.

The two members of this formation thicken southwestwardly, as do also the rocks of the previously mentioned formations on which they repose, but under different and peculiar conditions.

At Grayson the whole formation measures ninety feet, with the "lowest" coal bed—a mere streak—jammed between its base and the top of the limestone.

At the north fork of Licking River the upper member is one hundred and fifty feet thick; while the lower one is only eight feet thick and contains a well-defined bed of iron ore and a twelve-inch coal-bed.

In Estill county the upper member measures two hundred feet; the lower has also increased to fifty feet, its accompanying ore bed being now workable; and its coal bed measuring twenty-seven inches in thickness.

From this last-named point to the south end of the line at the Tennessee State line the peculiar character of this formation shows itself in a marked manner; its lower member increasing to an average thickness of two hundred and twenty-five feet and containing two workable and three other thin beds of coal and three well-defined horizons of shale containing iron ore; its upper member nowhere exceeding eighty feet in thickness.

The point of sudden change lies geographically between the top of the ridge dividing the Red and Kentucky Rivers and the valley of the Kentucky River itself.

The "lowest" coal bed holds its place throughout the belt; the other sub-conglomerate coals, mentioned above, coming in one by one above it; and in proportion to the constant thickening of the lower member of the formation.

Back from the greatly eroded and boldly-rising wall of the Conglomerate, which always marks the western margin of the East Kentucky coal field, lie, thinly spread over a plateau trenched by ravines, the lowest layers of the Lower Coal Measures proper.

2d. All the formations mentioned above dip to the southeast, making the western side of a wide and shallow synclinal trough.

3d. This great wave, having its axis in a direction N.N.E. and S.S.W., is itself crossed by undulations of no great height and depth, having their axes W.N.W. and E.S.E. Gentle as those undulations were, they were quite sufficient to determine the principal lines of drainage which issue from the mountain country into the plain.

4th. All the formations examined along the base line thicken, and also rise above sea-level, going towards the southwest.

5th. The lowest sub-conglomerate coal varies in thickness, but is persistent throughout the whole extent of the belt surveyed, a distance of about two hundred miles.

6th. Different species of trees mark the outcrops of the different geological formations. The sugar-tree and other maples and the white oak are characteristic of the base of the Devonian "Knobstone" series. Beech and red cedar grow on the sub-carboniferous limestones. Pine, hemlock, laurel and holly possess the conglomerate cliffs and peaks. Chestnut and oak forests cover the shales and sandstones of the great plateau bordered by the conglomerate bluffs.

SYNOPSIS OF THE HISTERIDÆ OF THE UNITED STATES.

By George H. Horn, M.D.

(*Read before the American Philosophical Society, June* 20, 1873.)

It is now twenty-eight years since the revision of the species of this family by Major John Leconte, and it has appeared to me that the time has arrived when a second revision is much needed. All the species known to Marseul have been described by him in his very exhaustive Monograph, and in supplements published from time to time, any new or old species previously unknown to him have been fully described. Numerous species are, however, still unknown in nature to Marseul, and his work is to that extent incomplete. To the large majority of our students, Marseul's Monograph is practically inaccessible, and as it deals with the species of the entire globe, the student of a limited fauna like our own finds it no easy matter to deal with the subject rendered all the more difficult by the vast number of species.

In the preparation of this essay I have availed myself of the cabinet and library of Dr. Leconte, which have at all times been as accessible as if they were my own. At this time I must also record the great kindness of M. de Marseul, who through the kind intercession of M. Aug. Sallé, loaned me many of his unique types for study, and also a similar favor on the part of M. Chevrolat. By these kind acts I have had before me for personal inspection, either the types of the majority of our species or those which are almost types by comparison with the types of authors.

The subdivision of the genera of this family into two tribes appears to me the most natural method, viz.:

Head porrected, mandibles very prominent.....HOLOLEPTINI.
Head retracted, bend downward, mandibles not very prominent..... HISTRINI.

Tribe HOLOLEPTINI.

This tribe contains in our fauna but one genus, Hololepta, formed by the union of that genus as recognized by Marseul and *Lionota*, the differences between the two do not appear to be sufficient for their separation.

Hololepta. Payk.

Head prominent, mandibles long produced in the plane of the body, not toothed, inner edge grooved in nearly their entire length for the reception of the maxillæ. Labrum deeply and broadly grooved apex, strongly bent downwards and triangular; on each side slightly notched by the mandibles. Mentum large, entirely corneous, triangularly emarginate in front for the reception of the tip of the labrum. Anterior tibiæ dentate on the inner edge at base, very near the articulation.

By means of these characters the genus Hololepta may be known from all those which follow. The antennæ are inserted under the margin of

the front, and the club has no distinct cavity for its lodgment, being merely received in a slight depression on the under side of the thorax in front of the coxæ.

The following are the species known to us :

Head with supra-orbital stria.
- Elytra without an entire stria ; propygidium smooth at middle ; mentum not carinate ; prosternum moderately prolonged in front but obtuse.
  - First and second striæ visible at base only, the second short..... ♂ Yucateca.
  - First and second striæ basal, the second very short, but with an apical portion extending forward to the end of the first stria..... ♀ *grandis*.
- Elytra with the second stria entire ; mentum with oblique ridge on each side ; prosternal lobe very acute in front ; pygidium and propygidium subopaque, the latter sparsely punctured at middle.
  - First elytral stria short, continued by a row of fine punctures, second entire..... cacti.

Head without supra-orbital stria; prosternum in front truncate
- Elytra with one stria entire.
  - Second stria entire, first short, basal.
    - Head without frontal stria ; sides of thorax smooth. quadridentata.
    - Head with sinuous frontal stria sometimes interrupted at middle ; sides of prothorax coarsely punctured..... vicina.
  - First stria entire, second very short.
    - Front not striate, sides of thorax with few punctures..... lucida.
- Elytra without entire striæ, first and second striæ short basal, the latter very short.
  - Second stria without apical appendicular stria..... fossularis.
  - Second stria with apical appendix, advancing forward nearly opposite the end of the first..... populnea.

H. Yucateca ♂, Mars. Mon. 1853, p. 203, pl. 5, fig. 1 ; 1860, p. 606 ; *grandis* ♀ Mars. l. c. p. 204, pl. 5, fig. 2 ; *princeps* Lec. Proc. Acad. 1859, p. 310.

Mentum transversely slightly concave, anteriorly triangularly emarginate, surface sparsely punctured and without elevated lines. Head with supra-orbital stria and a slight process on each side behind the mandibles. Elytra with two short dorsal striæ, the inner very short and without apical appendix to second ♂, or with apical appendix reaching nearly the tip of the first ♀ ; subhumeral deeply impressed extending two-thirds the length of the elytra. Propygidium smooth with fine punc-

tures at the sides only, pygidium coarsely but not densely punctured. Lower crest of hind tibiæ not dentate. Epipleuræ unistriate. Length .36–.40* inch ; 9–10 mm.

The above synonymy is that of Marseul, confirmed by a comparison with a specimen from Mexico.

The species has a wide distribution, occurring from Cajon Pass, California, to Camp Grant, Arizona.

H. cacti. Lec. Ann. Lyc. V., p. 162 ; Mars. Mon. 1857, p. 400, pl. 10, fig. 5.

Mentum coarsely punctured, triangularly emarginate, with an elevated line extending obliquely from the hind angles to the middle of the emargination on each side. Prosterum in front acute. Supra-orbital stria as in the preceding, front on each side near the base of mandibles with rudimental frontal stria. First dorsal stria short, not reaching the middle ; second entire, subhumeral moderately deep extending from apex to basal fourth. Propygidium shining at middle, opaque at the sides and apex, and coarsely and sparsely punctured ; pygidium opaque, sparsely and equally punctured. Hind tibiæ as in the preceding species. Length, .20–.30 inch ; 5–7.5 mm.

Occurs with the preceding. My specimens of both were taken in decomposing Cereus.

H. quadridentata, Fab. Ent. Syst. I., p. 74 ; Payk. Mon. p. 109, pl. 9, fig. 4 ; Mars. Mon. 1853, p. 212, pl. 5, fig. 10 ; 1860, p. 608 ; *platysma*, Er. Jahr. 1834, p. 95.

Mentum slightly concave transversely, sparsely punctured and with feeble oblique line, in front triangularly emarginate. Head without supra-orbital stria. Elytra with two dorsal stria, first short extending one-third, second entire, slightly arcuate, subhumeral moderately deep, extending three-fourths to base. Propygidium shining coarsely punctured at the sides, pygidium opaque, coarsely and equally punctured. Hind tibiæ with the lower and upper crests dentate. Epipleuræ smooth unistriate. Length .16–.20 inch, 4–5 mm.

Occurs in the Southern States, West Indies and South America.

In the males the anterior angle of the thorax has a moderately deep fossa ; the females are devoid of it.

H. vicina, Lec. Ann. Lyc. V., p. 163.

Head without supra-orbital stria, a bisinuate frontal stria. Mentum transversely concave, shining, sparsely punctured. Thorax punctured at the sides. Elytra with the second dorsal entire, first short, scarcely one-third, subhumeral four-fifths the length of the elytra. Propygidium

*All measurements in the present paper are made from the anterior margin of the thorax to the tip of the elytral suture ; the same method is used by Marseul.

coarsely, and very sparsely punctured: pygidium cribrately punctured. Lower hind tibial crest not dentate. Length .20 inch; 5 mm.

The first dorsal has sometimes a short apical appendix.

The sexes are marked as in the preceding species.

Collected near San Diego, California.

H. lucida, Lec. Bost. Journ. V., p. 37, pl. 1, fig. 2; Mars. Mon. 1853, p. 177, pl. 4, fig. 18.

Mentum transversely concave, smooth, triangularly emarginate in front. Thorax punctured at the sides, marginal stria entire. Elytra with first dorsal entire, second short basal, rarely with a very short apical appendix, third punctiform, basal, subhumeral deep abbreviated at both ends. Propygidium smooth at middle, coarsely punctured at the sides and apex, pygidium coarsely and equally punctured. Hind tibiæ with upper crest alone dentate. Length .20 inch; 5 mm.

Occurs in the Middle States and Kansas.

H. fossularis ♂, Say, Journ. Acad. 1825, p. 47; Lec. Bost. Journ. V., p. 37, pl. 1, fig. 1; Mars. Mon. 1853, p. 147, pl. 4, fig. 5; *æqualis* ♀, Say, loc. cit.

Resembles the preceding, but differs in the striation of the elytra. The first stria is short, not larger than a fourth of the elytra, the second shorter, and the third merely a trace, subhumeral deep. Otherwise as in *lucida*. Length .20 inch; 5 mm.

Occurs with the preceding.

H. populnea, Lec. Ann. Lyc. V., p. 163; Mars. Mon. 1860, p. 592, pl. 11, fig. 5.

Mentum as in *lucida*. Thorax very sparsely punctured at the sides. Elytra with first dorsal short, scarcely a third the length of the elytra; second shorter, and with an apical appendix frequently advancing opposite the tip of the first. Propygidium smooth, at sides very sparsely punctured, pygidium sparsely punctured. Hind tibiæ as in *lucida*. Length .18 inch; .45 mm.

Occurs in Arizona, between the layers of dead Cottonwood bark.

Tribe HISTRINI.

This tribe may be again subdivided:

Prosternum distinctly lobed in front..... HISTRINI.
Prosternum not lobed in front..... SAPRINI.

The prosternal lobe appears to be a piece distinct from the prosternum, and between the two the suture is more or less distinct. In the majority of cases the lobe is provided with a lateral extension, which joins the prothoracic epipleuræ, and when it exists is called the pectoral plate. In every case when the pectoral plate exists it forms part of the boundary of the antennal fossa, and usually renders the latter partially invisible from beneath.

Th subtribes as thus defined are essentially the same as in the "Classi-

fication" of Dr. Leconte. *Bacanius* has been removed from the first and placed near *Acritus* in the second, the reasons for which will be given in the proper place. *Tribalus* has the prosternal lobe short, but its lateral prolongations form the lower boundary of the antennal fossa, a structure which cannot exist in the second sub-tribe.

Sub-Tribe Histrini.

This sub-tribe contains in our fauna the larger number of genera and species.

The genera are thus distinguished:

Antennal cavities at the anterior angle of the thorax, usually closed beneath more or less entirely by the pectoral plate, but open in front.
- Antennal club more or less oval, pubescent, and usually, distinctly annulated.
  - Mandibles moderately prominent, upper edge rounded, not clasping the epistoma, labrum trapezoidal.
    - Antennal club broadly oval, distinctly annulated, elytra never acutely margined ..... Hister.
    - Antennal club elongate oval, apparently solid but pubescent, elytra acutely margined ..... Tribalister.
  - Mandibles retracted, upper edge acute, at base clasping the epistoma, labrum short, very transverse.
    - Prosternum broad, lobe short, elytra scarcely striate, form ovate ..... Tribalus.
    - Prosternum moderate, lobe moderately prolonged, elytra striate, form oblong ..... Epierus.
- Antennal club obconical, solid, glabrous.
  - Prosternal lobe thick, horizontal. Epistoma truncate, labrum normal ..... Hetærius.
  - Prosternal lobe thin, broad, deflexed. Epistoma bifurcate, labrum small ..... Echinodes.

Antennal cavities slightly behind the anterior angles, open beneath, closed in front by the thickening of the inflexed portion of prothorax.
- Antennæ frontal ..... Onthophilus.

Antennal cavities at the middle of the thorax beneath, in front of the outer portion of the coxæ, prosternal plate not prolonged laterally.
- Anterior tibiæ with moderately large terminal spur...
  - Anterior tibiæ dilated, middle and hind tibiæ slender ..... Paromalus.
  - Tibiæ all dilated ..... Dendrophilus.
- Anterior tibiæ with small terminal spur. Anterior tibiæ slightly dilated, middle and hind tibiæ slender ..... Anapleus.

Many species of Hister (*arcuatus, lævipes, interruptus, etc.*), have no proper pectoral plate, and the antennal cavity is entirely uncovered. This character cannot be made use of in a systematic manner, as the transition is so gradual from one form to the other.

In the last three genera, the funicle of the antennæ when at rest passes through an incisure between the prosternum proper and the episternum. The prosternal lobe in Dendrophilus is broader and shorter than in Paromalus.

Hister, Linn.

For convenience of study this genus may be divided into the following sub-genera, some of which have been considered sufficiently well founded as to have been retained as genera. In the scheme published by Dr. Leconte, Proc. Acad. 1852, p. 38, they have all been united under the name Hister, subsequently, Class Col. N. A. p. 76, *Phelister* alone was separated, at the same time doubts were expressed as to the propriety of the course.

Anterior tibiæ with the tarsal groove badly defined, straight.
- Internal marginal thoracic stria more or less distinct, always entire; mesosternum emarginate or truncate at apex.
  - Hind tibiæ broad at base, with a single row of spines..... *Psiloscelis.*
  - Hind tibiæ narrow at base, two rows of spines.
    - Elytral striæ obliterated, surface opaque, punctured with smooth flattened tubercles..... *Margarinotus.*
    - Elytra striate..... *Hister.*
- Internal marginal thoracic stria entirely absent; mesosternum more or less produced in front, prosternum at tip emarginate.
  - Hind tibiæ with two rows of spines; elytra striate. *Phelister.*

Anterior tibiæ with tarsal groove well defined; internal marginal thoracic stria entirely absent. Middle and hind tibiæ dentate.
- Anterior tibiæ without tooth on inner margin; prosternum at apex flattened and without marginal line..... *Platysoma.*
- Anterior tibiæ with a small internal tooth near the base; prosternum convex and with marginal line... *Cylistix.*

Sub-genus *Psiloscelis.*

Thorax with two marginal striæ closely approximated, the outer very close to the margin. Hind tibiæ scarcely narrower at base than apex, strongly compressed, and with a single row of spines, anterior tibiæ feebly dentate. Epipleuræ bistriate. Elytra with subhumeral stria abbreviated at apex. Surface densely punctured.

Prosternum with marginal line at tip; surface opaque, foveolato-punctate ..... planipes.
Prosternum not margined; surface moderately shining, coarsely punctured..... subopacus.

H. planipes, Lec. Proc. Acad. 1852, p. 39; *Harrisii*‖ Lec. Bost. Journ. V., 1845, p. 14, pl. 1, fig. 11; Mars. Monog. 1853, p. 542, pl. 16, fig. 1.

Black, opaque, thorax less opaque than the elytra. Head densely punctured, frontal stria well marked. Thorax densely and equally punctured. Elytra opaque, foveolato-punctate, with six dorsal striæ, of which four are entire, the fifth and sutural approaching at base and obliterated, humeral stria very short, subhumeral moderately impressed obliterated at apex. Pygidium and propygidium densely foveolato-punctate, the latter less densely than the former. Body beneath more shining than above, foveolato-punctate. Prosternum with marginal line at apex. Legs shining, sparsely punctate. Length .26 inch; 6.5 mm.

Occurs from Massachusetts to Georgia.

H. subopacus, Lec. New Species, 1863, p. 60.

Subopaque. Head densely punctured, frontal stria deeply impressed. Thorax coarsely and densely punctured, more densely at the sides. Elytra coarsely and rather densely punctured, punctures of sutural interval fine; each elytron with six dorsal striæ, the sutural and fifth abbreviated at base, humeral stria very short, subhumeral moderately impressed, abbreviated at base and continued at apex, by a row of coarse punctures. Propygidium and pygidium coarsely punctured, the latter more densely. Body beneath more shining than above, coarsely punctured at the sides, more finely and less densely at middle. Femora sparsely punctate. Prosternum without marginal line at tip. Length .24 inch; 6 mm.

Narrower, less convex and less opaque than *planipes*, and readily known by the absence of the marginal line at apex of prosternum.

Two specimens are known, collected in Nebraska and Vancouver.

Sub-genus *Margarinotus.*

Marginal striæ of thorax confused, scarcely visible, the inner very distant from the margin. Hind tibiæ slender at base, biseriately spinulose, anterior five dentate, the upper tooth small. Elytra with the intervals of the striæ with smooth sub-depressed tubercles, striæ almost entirely obliterated. Epipleuræ of elytra either unistriate (*guttifer*) or not striate (*scaber*).

The only character separating *Margarinotus* from *Hister* is the sculpture of the surface of the body; and not recognizing this to have any great importance, I have united the former genus to the latter.

H. guttifer, Horn. Proc. Ent. Soc. 1862, p. 167; Trans. Ent. Soc. 1870, pl. 1, fig. 5.

As the sculpture of this insect has been as nearly produced as the varying tendencies of the individuals admit, nothing further need here

be added. Between the punctures, however, the striæ, in a partially obliterated condition appear, and at the sides an almost entire subhumeral appears. Thorax without external marginal stria, inner stria nearly obliterated and very distant from the margin. Epipleuræ of elytra unistrate. Length .18–.20 inch ; 4.5–5 mm.

Occurs along the eastern base of the Rocky Mountains, from Nebraska to Texas.

The only other species of the sub-genus is the *scaber* of Southern Europe. The two differ primarily in the surface sculpture particularly that of the thorax, and which can be best seen by a comparison of the figures of the two. The outer marginal striæ of the thorax do not exist in *guttifer*, two are said to exist in *scaber*, of which however one only is at all distinct. The subhumeral stria is nearly obliterated in *scaber* and almost entire and very distinctly impressed in our own. The epipleuræ are punctured and not striate in the former and very distinctly unistriate in the latter. The under surface of the body is coarsely punctured in the former and nearly smooth at middle in the latter, and the femora of of each species partake of the sculpture of the under surface. Both species are broadly oval.

Sub-genus *Hister*.

Thorax with two lateral marginal striæ and occasionally with the evidences of a third. Hind tibiæ narrower at base than at apex and biseriately spinulose and rarely with the spinules somewhat confused, anterior tibiæ variable, either bi-, tri- or multidentate. Elytra always striate. Tarsal groove of anterior tibiæ badly defined.

The sub-genus Hister as above restricted contains a very large number of species which for convenience may be divided into groups.

Margin of thorax ciliate, Antennal cavities shallow.
- Outer marginal thoracic stria entire, anterior tibiæ dentate ..... Gr. *arcuatus*.
- Outer marginal stria abbreviated, anterior tibiæ not dentate ..... Gr. *laevipes*.

Margin of thorax not ciliate, Antennal cavities deep.
- Mesosternum emarginate.
  - Subhumeral stria entire.
    - Elytra 3-striate ; outer thoracic stria very close to margin ..... Gr. *sexstriatus*.
    - Elytra 4-striate ; outer thoracic stria often absent or when present distant from margin.
      - Outer thoracic stria entire ..... Gr. *merdarius*.
      - Outer thoracic stria much abbreviated or absent. Gr. *foedatus*.
  - Subhumeral stria interrupted, often entirely obsolete.
    - Tibiæ serrulate ..... Gr. *abbreviatus*.
    - Tibiæ tridentate ..... Gr. *depurator*.
- Mesosternum truncate (*Atholus*, Thoms.)
  - Epipleuræ very narrow, unistriate ..... Gr. *bimaculatus*.
  - Epipleuræ bistriate and broader ..... Gr. *americanus*.

Owing to the difference which have resulted, by the adoption of the above method of subdivision, the system of numbering the groups has not been adopted, and in lieu thereof a typical and usually a common species has been selected as the representative of each group, in order that the groups here made might not be confounded with those of Marseul and Dr. Leconte.

Group *Arcuatus*.

Species of robust form. Thorax with entire margin ciliate. Antennal cavities shallow. Anterior tibiæ usually bidentate.

The following species compose this group:

Thorax with apical intermediate confused stria.
- Elytra with three dorsals and a sutural stria..... arcuatus.
- Elytra with three dorsals only..... sellatus.

Thorax with two thoracic striæ only.
- Anterior tibiæ bidentate.
  - Prosternal lobe acute..... Gloveri.
  - Prosternal lobe rounded at apex.
    - Elytra with no subhumeral stria.
      - Hind tibiæ with outer row of spinules densely placed; thorax densely fimbriate..... instratus.
      - Hind tibiæ sparsely spinulose; thorax densely fimbriate..... biplagiatus.
    - Elytra with apical subhumeral, usually deeply impressed..... Ulkei.
- Anterior tibiæ tridentate apical tooth divided.
  - No subhumeral stria..... lucanus.

H. arcuatus, Say. Journ. Acad. 1825, p. 34; Mars. Monog. 1854, p. 258, pl. 7, fig. 62.

External and internal thoracic striæ entire gradually approaching at base, and between them at apex a confused intermediate stria extending usually beyond the middle. Three entire dorsal striæ to the elytra, a short basal fourth, and a sutural extending in front of middle. Subhumeral feeble at apex, humeral appendix usually deeper. Elytra black with arcuate red space at middle of each. Hind tibiæ with spinules confusedly arranged. Anterior femora brownish, middle and hind femora red tipped at each end with black. Length .26 inch; 6.5 mm.

Occurs in the Middle States, but not common.

H. sellatus, Lec. Pacif. R. R. Rep. 1857, p. 37; *Senevillei*, Mars. Mon. 1857, p. 422, pl. 10, fig. 119.

More elongate than the preceding, and with similar thoracic striation. The elytra have three striæ and a mere rudiment of a fourth at base, the sutural is entirely obsolete. The subhumeral stria is entirely wanting, with rarely but a trace represented by a few punctures, the humeral appendix being entirely wanting. The hind tibiæ are spinulose

in three oblique series. The elytra are entirely red with a narrow apical margin, and sub-scutellar trapezoidal spot black. Legs entirely black. Length .22 inch ; 5.5 mm.

Occurs in California and Oregon.

H. Gloveri, Horn, Trans. Am. Ent. Soc. 1870, p. 134.

Form robust as in *arcuatus*. Thorax with two entire striæ. Elytra with three entire dorsal and a short sutural stria. Subhumeral stria obsolete replaced by a few punctures, humeral appendix short, moderately impressed. Prosternal lobe acutely produced in front. Hind tibiæ biseriately spinulose. Legs piceous. Color variable. Length .22–.26 inch ; 6.5 mm.

From all the species of the group this may be once known by the very acute prosternal lobe. In the typical specimen the color is entirely black, while a variety in the cabinet of Dr. Leconte has the elytra colored as in *biplagiatus*, but with less distinctness of definition between the black and red portions.

Kansas and Indian Territory.

H. instratus, Lec. Col. Kansas, 1859, p. 7.

Similar in form to *sellatus*. Thorax with lateral striæ both entire and with no apical intermediate striæ. Elytra with three entire dorsal striæ, a rudiment of a fourth and moderately long sutural, subhumeral stria wanting or with merely a faint trace of a short humeral appendix. Elytra colored as in *sellatus*. Legs colored as in *arcuatus*. Hind tibiæ biseriately spinulose. Length .22 inch ; 5.5 mm.

His species is very closely allied to *biplagiatus*, Lec., but differs by its more robust form, its more distinctly fimbriate thorax, and by the outer row of spinules of the hind tibiæ being composed of spinules very closely approximated. In the specimen before me there is a very short appendicular stria under the humeral prominence very feebly impressed, which never exists in any *biplagiatus* that I have seen. From *Gloveri* it differs in having the tip of the prosternal lobe broadly rounded and not acute.

Occurs in Kansas.

H. biplagiatus, Lec. Bost. Journ. V., p. 55, pl. 3, fig. 4 ; Mars. Mon., 1854, p. 552, pl. 9, fig. 119.

There is no trace whatever of subhumeral stria or humeral appendix in any specimens before me. There are three entire dorsal striæ and rarely a trace of the fourth at base. The sutural frequently extends one-half to base, usually much shorter. Thorax sparsely fimbriate, hind tibiæ distantly spinulose, legs black or piceous. Length .20 inch ; 5 mm.

Abundantly distributed from the Middle States to Georgia, and westward to Kansas.

H. Ulkei, Horn, Trans. Am. Ent. Soc., 1870, p. 134; *arizonæ*, Horn, l. c., p. 135.

Resembles the preceding in form and coloration, and differs in the presence of an apical subhumeral stria extending two-thirds to base, close to the first dorsal, and rarely with a short subhumeral appendix. There is also a fourth dorsal at apex of varying length, sometimes extending in front of middle, and more rarely the traces of a fifth. The hind tibiæ agree with those of *biplagiatus*. Legs black or piceous. Length .16–.22 inch; 4–5.5 mm.

Occurs in Kansas, Nebraska, Colorado and Arizona.

H. lucanus, n. sp.

Thorax sparsely fimbriate, lateral striæ two, entire, at base coarsely punctured, punctures more numerous and coarser toward the sides. Elytra red with sides, apex and trapezoidal scutellar spot black, three entire dorsal striæ and a sutural extending in front of middle. Epipleuræ bistriate. Anterior tibiæ tridentate, the upper tooth feeble, the apical bifid. Hind tibiæ biseriately spinulose. Body beneath and legs black and shining. Length .12 inch; 3 mm.

Resembles *biplagiatus* but easily known by the form of the anterior tibiæ. The subhumeral stria is entirely wanting. One specimen, Cape San Lucas, Lower California.

Group *Lævipes.*

Anterior tibiæ of elongate triangular, outer margin straight, not dentate. Thorax bistriate, outer stria close to the margin and somewhat abbreviated. Epipleuræ bistriate, subhumeral short, apical. Antennal cavities shallow.

H. lævipes, Germ., Ins. spec. nov. p. 87; Lec. Bost. Journ. V., p. 50, pl. 1, fig. 7; Mars. Mon., 1854, p. 233, pl. 7, fig. 49.

Elytra with three entire dorsal striæ, a very short basal fourth and an almost entire sutural. Subhumeral stria apical, close to the first dorsal and half its length. Propygidium sparsely punctured at the sides, smooth at middle, pygidium convex smooth with a very few punctures at the sides. Legs black, smooth. Length .14–.18 inch; 3.5–4.5 mm.

Occurs from Pennsylvania to Georgia.

This species is the only one in our fauna belonging to this group, and may be distinguished from every other by the simple anterior tibiæ.

Group *Sexstriatus.*

Thorax bistriate, outer stria close to the margin, and abbreviated at each end. Anterior tibiæ quadridenticulate, apical tooth bifid. Antennal cavities deep, partially enclosed by the prolongation of the sides of the prosternal lobe. Hind tibiæ subtridentate.

H. sexstriatus, Lec. Ann. Lyc. V., p. 163; Mars. Mon., 1854, p. 290, pl. 8, fig. 86.

Anterior angles of thorax sparsely and finely punctured, more coarsely

punctured along a narrow basal space especially at the sides. Elytra with three entire dorsal striæ, sutural obsolete, subhumeral entire and straight. Pygidium and propygidium coarsely but not densely punctured, the latter the more sparsely. Length .22–.28 inch; 5.5–7 mm.

Occurs in California.

Group *Merdarius*.

Thorax bistriate, outer stria entire and as distant from the margin as from the inner stria, this latter usually shorter than the outer. Anterior tibiæ quadridentate, hind tibiæ biseriately spinulose. Elytra with four entire striæ. Epipleuræ unistriate, subhumeral stria entire. Antennal cavities deep.

Surface above, sparsely punctured..... Harrisii.

Surface smooth.

Apical tooth of anterior tibiæ more prominent than the second..... merdarius.

Apical tooth much less prominent than the second.

Sutural stria long extending in front of middle..... { interruptus. stygicus.

Sutural stria very short, apical..... immunis.

H. Harrisii, Kby. Fauna Bor. Am. IV., p. 124; Lec. Bost. Journ. V., p. 49, pl. II, fig. 5; Mars. Mon., 1854, p. 299, pl. 8, fig. 92.

Surface sparsely and equally punctured. Anterior tibiæ quadridentate, apical tooth shorter than second. Thorax bistriate, outer stria entire and arcuate at base, inner slightly shorter than the outer, and confused at basal end. Elytra with four entire striæ, fifth extending to middle, sutural longer than the fifth, subhumeral entire. Propygidium and pygidium coarsely and rather densely punctured and subopaque. Length .16–.20 inch; 4–5 mm.

Occurs from the Middle States to Georgia.

H. merdarius, Hoffm. Ent. Hefte, 1, p. 39, pl. 1, fig. 3; Lec. Bost. Journ. V., p. 47, pl. 2, fig. 1; Mars. Mon., 1854, p. 297, pl. 8, fig. 91; *memnonius*, Say. Journ. Acad., 1825, p. 32.

Sides of thorax with a few sparsely placed punctures, bistriate, outer stria entire and straight, inner somewhat sinuous, frequently slightly shorter than the outer. Elytra with three entire striæ, fourth slightly abbreviated at base, fifth and sutural nearly equal, extending to the middle, subhumeral entire nearly straight. Anterior tibiæ quadridentate, apical tooth more prominent than the second, and slightly notched at the tip. Propygidium sparsely punctured, pygidium more densely and equally punctured. Length .20–.22 inch; 5–5.5 mm.

Occurs in the Middle States, is common in Europe.

H. interruptus. Beauv. Ins. 180, pl. 66, fig. 8; Mars. Mon., 1854, p. 295, pl. 10, fig. 90; *obtusatus*, Harris, Trans. Nat. Hist. Soc. Hartford, No. 1; Lec. Bost. Journ. V., p. 47, pl. 2, fig. 2.

Thorax at sides smooth, bistriate, striæ entire, equal, straight. Elytra with three entire striæ, fourth slightly abbreviated at base, fifth short, apical, sutural extending in front of middle, subhumeral entire. Propygidium coarsely but sparsely punctured, pygidium more finely and sparsely punctured, nearly smooth at apex. Anterior tibiæ sub-5-dentate, apical tooth shorter than second and slightly bifid. Length .20–.26 inch ; 5–6.5 mm.

Middle and Western States, common.

H. stygicus, Lec. Bost. Journ. V., p. 48, pl. 2, fig. 4 ; Mars. Mon., 1854, p. 301, pl. 9, fig. 94.

There are absolutely no characters on which to separate this species from *interruptus* excepting the following :

Species much smaller, form more broadly oval, thoracic striæ entire, parallel and equi-distant from each other, and from the margin. Elytral striæ exactly as in *interruptus*. Propygidium coarsely but very sparsely punctulate, pygidium shining very minutely and sparsely punctulate. Length .10 inch ; 2.5 mm.

The species is described as having four entire striæ, the fourth stria is abbreviated at base. Marseul mentions a basal arc opposite the fifth stria ; this may or may not be present in any species of this group. The head is said to have an impressed point at middle of front ; of the two typical specimens one has it, the other has not.

Two specimens from Georgia.

H. immunis, Er. Jahrbuch, 1834, p, 143.

Sides of thorax bistriate, striæ entire, parallel and straight. Elytra with three entire striæ, fourth slightly abbreviated at base, fifth very short, apical, sutural either very short or entirely obsolete, subhumeral entire. Propygidium coarsely and evenly punctured, pygidium more finely punctured especially at apex. Anterior tibiæ sub-5-dentate, apical tooth shorter. Length .20 inch ; 5 mm.

Occurs in the Middle States, and also in California.

Group *Foedatus*.

Inner thoracic stria entire or very nearly so, outer either entirely absent or very much abbreviated. Anterior tibiæ multidentate.

Thoracic margin thickened, inner stria entire ; epipleuræ unistriate ..... marginicollis.

External thoracic stria entirely obliterated.

Thoracic margin not thickened.

Stria posteriorly abbreviated ; epipleuræ unistrate .... cognatus.

Stria entire ; epipleuræ bistriate ..... remotus.

External thoracic visible, usually very short, rarely half the length of the inner.

Inner stria slightly abbreviated at tip ; epipleuræ unistriate ..... foedatus.

H. marginicollis, Lec. Bost. Journ. V., p. 58, pl. 3, fig. 11; Mars. Mon., 1854, p. 542, pl. 9, fig. 113.

Surface of thorax minutely punctulate, at sides sparsely punctured near the base, inner stria entire, margin convex. Elytra with three entire dorsal striæ, fourth abbreviated at base, extending slightly in front of middle, fifth very short, apical, sutural as long as the fourth, subhumeral entire. Epipleuræ unistriate. Pygidium and propygidium sparsely and rather coarsely punctured. Anterior tibiæ 5-dentate, teeth acute. Length .18 inch; 4.5 mm.

Middle States rare. Marginal line of prosternal lobe distinct, entire.

H. cognatus, Lec. Bost. Journ. V., p. 58, pl. 3, fig. 10; Mars. Mon., 1857, p. 421, pl. 10, fig. 111.

Lateral stria of thorax abbreviated at tip, confused by punctures which also extend forward on its inner side. Elytra with three entire dorsal striæ, fourth nearly entire, fifth short apical, sutural rarely extending in front of middle, subhumeral entire. Pygidium and propygidium coarsely and evenly, but not densely punctured. Anterior tibiæ sub-5-dentate, apical tooth very small. Length .10–.14 inch; 2.5–3.5 mm.

Closely resembles *foedatus*, but the absence of an exterior thoracic stria as well as the margined prosternal lobe at once distinguish it. Two specimens are before me in which the punctures within the inner stria of the thorax are entirely absent, and the stria longer, but I feel unwilling to separate them on these characters without a larger series of specimens.

Middle States, Canada, Illinois, Wisconsin. Not rare.

H. remotus, Lec. Proc. Acad., 1859. p. 70.

Sides of thorax near the stria with few punctures, stria distant from the margin, entire and slightly sinuous. Elytra with three entire dorsal striæ, fourth slightly abbreviated at base, fifth one-third the length of the elytra, sutural somewhat longer, subhumeral entire. Propygidium coarsely and sparsely, pygidium more densely punctured. Prosternal lobe with marginal line distinct. Anterior tibiæ pluridentate. Length .16 inch; 4 mm.

This species is the most oblong of any in the group.

Occurs at Fort Tejon, California.

H. foedatus, Lec. Bost. Journ. V., p. 50, pl. 2, fig. 8; Mars. Mon., 1854, p. 292, pl. 8, fig. 88.

Outer marginal stria of thorax usually forming a short arc near the anterior angle, rarely extending half the length of the thorax, inner stria usually abbreviated at tip. Disc of thorax very minutely punctulate, at the sides more distinctly punctured near the stria. Elytra with three entire striæ, fourth slightly abbreviated; fifth one-third, sutural one-half the length of the elytra, subhumeral entire. Pygidium and propygidium densely punctured. Anterior tibiæ pluridentate. Length .14–.22 inch; 3.5–5.5 mm.

The prosternal lobe has the marginal line entirely obliterated in the

large majority of specimens. A variety occurs in the cabinet of Dr. Leconte, bearing the manuscript name *proximus* in which the sides of the thorax are scarcely at all punctured, the outer stria at its maximum, and the prosternal lobe with the marginal line distinct. I feel unwilling to separate it, however, as the characters are those which are the most likely to be variable, and transitional forms in one or other character constantly appear. A variety occurs in Oregon and Vancouver with the outer thoracic stria half the length of the inner, the prosternum not margined, and the form approaching *remotus*. These have been associated with the latter species in cabinets, but the outer thoracic stria and the unistrate epipleuræ at once distinguish it.

Occurs from Canada to Georgia, and westward to Vancouver and Oregon.

Group *Abbreviatus*.

Subhumeral stria interrupted, often very short or even entirely absent. Anterior tibiæ serrulate or mutic. This group and the following may be distinguished from the three which immediately precede by the interrupted or even entirely absent subhumeral stria. This stria when present may be represented by the basal or the apical portion, sometimes both are present and are usually separated; when they are united the union is produced by the extension of a few punctures from the humeral portion, which do not however join the end of the apical portion. The stria never presents that straight continuous form of the preceding groups. The subhumeral in the preceding groups is always the external, and is more distant at apex from the first dorsal than the latter is from the second. The subhumeral in this and the next group is internal, and nearer the first dorsal than the latter is from the second, and when the humeral appendix forms an union with the apical portion, as above indicated, the basal tip of the latter always passes beyond this point in the direction of the fine oblique humeral stria, which is really the continuation of an internal subhumeral.

The species of this group have the anterior tibiæ sometimes multidenticulate, usually serrulate and rarely nearly mutic, the serrulations being composed of spinules, and are independent of any denticulation of the tibia itself.

Subhumeral stria apical, deeply impressed.
- Outer margin of anterior tibiæ regularly arcuate, minutely serrulate.
  - Front flat; anterior tibiæ multidenticulate..... cœnosus.
  - Front with a moderate impression; anterior tibiæ finely quadridentate..... punctifer.
- Outer margin of anterior tibiæ sinuate and multidentate.
  - Subhumeral with humeral appendicular stria.....abbreviatus.

Subhumeral entirely obliterated or with mere trace.
- Elytra 3-striate, outer thoracic very short or absent.
  - Anterior tibiæ finely serrulate or mutic; outer thoracic stria visible at apex..... civilis.

H. cœnosus, Er. Jahrb., 1834, p. 154; Mars. Mon., 1854, p. 276, pl. 8, fig. 76; *decisus*, Lec. Bost. Journ. V., p. 51, pl. 2, fig. 10; *repletus*, Lec. loc. cit. p. 49, pl. 2, fig. 6.

Thorax bistriate, inner stria entire, outer abbreviated but extending beyond the middle, and between the two stria at apex are either a few punctures or a very short stria. Front not impressed. Elytra with four entire striæ, a fifth extending to middle and the sutural longer, subhumeral at apex deeply impressed, and with a very short feebly impressed humeral appendix. Epipleuræ bistriate. Propygidium very sparsely punctured, pygidium very minutely punctulate, and with a few coarser punctures near the sides. Anterior tibiæ with the outer margin regularly arcuate, minutely denticulate. Hind tibiæ biseriately spinulose. Length .18–.22 inch; 4.5–5.5 mm.

I cannot find that *repletus* differs except in having the fifth dorsal stria a trifle longer.

Occurs from the Gulf States to Mexico.

H. punctifer, Payk. Mon. p. 25, pl. 4, fig. 1, Lec. Bost. Journ. V., p. 51, pl. 2, fig. 9; Mars. Mon., 1854, p. 265, pl. 8. fig. 67.

The surface sculpture of this species is precisely that of *cœnosus*, and differs as follows: Head with a shallow fovea. Outer thoracic stria not extending to middle. Humeral appendicular stria short deeply impressed. Propygidium on each side with a shallow impression. Anterior tibiæ feebly quadridentate. Length .22 inch; 5.5 mm.

One specimen said to have been found in the Middle States, corresponding exactly with Marseul's description, is before me.

H. thoracicus, Payk. Mon. p. 20, pl. 2, fig. 5.

From the description this species appears to be allied to the preceding. It is, however, entirely unknown, either to us or Marseul.

H. abbreviatus, Fab. Syst. Ent. p. 53; Lec. Bost. Journ. V., p. 52, pl. 2, fig. 11; Mars. Mon., 1854, p. 283, pl. 8, fig. 82; *subhemisphericus*, Beauv. Ins. p. 180, pl. 6, fig. 7; *bifidus*, Say, Journ. Acad. 1825, p. 34; Lec. loc. cit. pl. 2, fig. 12; Mars. loc. cit. p. 284, pl. 8, fig. 83.

Thorax at sides bistriate, outer stria extending to middle, inner entire. Elytra with four entire striæ coarsely punctured, fifth short, apical, sutural half the length of the elytra. Subhumeral at apex deeply impressed, with humeral appendix extending to base, also deeply impressed, and joining the apical portion behind its tip. Propygidium coarsely and sparsely punctured, pygidium nearly impunctate. Anterior tibiæ feebly 4-dentate apical tooth bifid. Length .12–.20 inch; 3–5 mm.

This species varies somewhat in the length of the outer thoracic striæ, as well as in the depth of the elytral striæ. One specimen before me has a mere trace of an external subhumeral near the apex.

Middle States to Georgia, and westward to Montana and Kansas.

H. civilis, Lec. Bost. Journ. V., p. 55, pl. 3, fig. 5; Mars. Mon., 1854, p. 570, pl. 9. fig. 134.

Inner thoracic stria entire, outer very short, forming merely an arc at the anterior angle. Elytra with three entire dorsal striæ, fourth existing merely as a trace at apex, sutural very short, subhumeral entirely absent. Propygidium coarsely and very sparsely punctured, pygidium more finely punctured and nearly smooth at apex. Anterior tibiæ very finely denticulate, often almost entirely mutic. Length .16 inch ; 4 mm.

By the entire absence of subhumeral stria, as well as by the nearly mutic anterior tibiæ this species is abundantly distinguished from any in the group.

Occurs from the Middle States to Illinois.

Group *Depurator*.

In this group the anterior tibiæ are denticulate, the teeth being formed by processes of the tibiæ itself, and not as in the preceding group merely spinules attached, so to speak, to the outer edge of the tibia.

The species are as follows :

Thorax unistriate ; elytra tristriate.
  Epipleuræ unistriate ; anterior tibiæ 4-dentate..... semisculptus.
  Epipleuræ bistriate ; anterior tibiæ 3-dentate..... dispar.
Thorax bistriate.
  Elytra tristriate.
    Apex of prosternal lobe truncate, on each side slightly prominent..... furtivus.
    Apex of prosternal lobe rounded, normal.
      Epipleuræ tristriate, fourth dorsal basal rudimentary ; no subhumeral..... incertus.
      Epipleuræ bistriate, fourth dorsal wanting or apical.
        Apical subhumeral moderately impressed, elytra black..... depurator.
        Subhumeral entirely wanting, elytra bicolored.... militaris.
  Elytra with four entire striæ.
    Outer thoracic stria abbreviated, usually very short.
      A short humeral appendix ; form oblong..... curtatus.
      No subhumeral whatever ; form broadly oval..... defectus.
    Outer thoracic stria entire.
      Pygidium smooth, very minutely punctulate..... indistinctus.
      Pygidium very coarsely punctured..... servus.

H. semisculptus, Lec. New Species, 1863, p. 60.

Inner stria of thorax alone entire, external entirely absent. Elytra with three entire striæ, fourth and fifth very short, sutural one-fourth the length of the elytra, subhumeral entirely absent at apex, a faintly impressed subhumeral appendix alone existing. Pygidium and propygidium coarsely and equally punctured. Epipleuræ unistriate. Anterior tibiæ with outer margin arcuate, 4-dentate, apical tooth bifid. Length .20 inch ; 5 mm.

This species by its oblong form recalls *remotus*. Differs from all the species of the present group by the unistriate epipleuræ.

One specimen, Illinois.

H. dispar, Lec. Bost. Journ. V., p. 57, pl. 3, fig. 8; *hospitus*, Lec. Proc. Acad., 1859, p. 312.

Thorax at sides unistriate, stria distant from the margin. Elytra with three entire striæ, sometimes with trace of fourth at base and apex, sutural extending three-fourths the length of the elytra, subhumeral entirely absent. Epipleuræ bistriate. Propygidium coarsely but very sparsely punctured, pygidium more finely punctured and nearly smooth at apex. Anterior tibiæ tridentate, apical tooth feebly bifid. Length .12–.16 inch; 3–4 mm.

Occurs in the Middle States, Georgia, Illinois and Kansas.

H. depurator, Say. Journ. Acad., 1825, p. 33; Lec. Bost. Journ. V., p. 54, pl. 3, fig. 3; Mars. Mon., 1854, p. 274, pl. 8, fig. 74; *Paykulli*, Kby. Faun. Am. Bor. p. 123; *spretus*, Lec. Bost. Journ. V., p. 53, pl. 3, fig. 1; Mars. Mon., 1854, p. 271, pl. 8, fig. 72.

Thorax bistriate, inner stria always entire, outer variable, sometimes nearly entire, more frequently extending to middle only. Elytra with three entire dorsal striæ, fourth apical rarely extending to middle, fifth existing in mere trace, sutural extending to middle, subhumeral at apex moderately deeply impressed, humeral appendix usually present always very feeble. Epipleuræ bistriate. Propygidium coarsely but very sparsely punctured, pygidium more finely punctured and nearly smooth at apex. Anterior tibiæ tridentate, upper tooth feeble, apical prominent and slightly bifid at tip. Length .22 inch; 5–.5 mm.

Distributed from Canada to Georgia.

H. furtivus, Lec. Proc. Acad., 1859, p. 313.

This species closely resembles the preceding, and differs by the total obliteration of the subhumeral stria. The apex of the prosternal lobe is truncate or emarginate with the sides of the emargination slightly prominent. This latter character will serve to distinguish it from every other species in our fauna. Length .20–.22 inch; 5–5.5 mm.

Occurs from Canada to Georgia.

H. incertus, Mars. Mon., 1854, p. 269, pl. 8, fig. 70.

Closely allied to *depurator*, but differs in the absence of any subhumeral stria, and the epipleuræ distinctly tristriate. Length .16–.24 inch; 4-6 mm.

Occurs from the Middle States to Florida and Texas, and westward to Kansas.

H. militaris, Horn, Trans. Am. Ent. Soc., 1870, p. 135, pl. 1. fig. 4.

Inner thoracic stria entire, outer very short, apical and between the two a few punctures. Elytra with three entire striæ, fourth extending to middle, fifth very short, apical, sutural half the length of the elytra,

subhumeral entirely absent. Epipleuræ bistriate. Pygidium and propygidium moderately densely and coarsely punctured. Anterior tibiæ tridentate, apical tooth feebly emarginate. Length .18 inch ; 4.5 mm.

Occurs at Fort Yuma, California.

Differs from all the species of the group by the color of the elytra, which are in great part red with the apical margin and trapezoidal scutellar spot black. The form is also sub-hexagonal.

H. curtatus, Lec. Bost. Journ. V., p. 54, pl. 3, fig. 2 ; Mars. Mon., 1854, p. 272, pl. 8, fig. 73.

Form oblong oval. Inner thoracic stria entire, outer very short, forming merely a short arc at the anterior angle. Elytra with four entire dorsal striæ, fifth short apical, sometimes extending to the middle, sutural longer than the fifth, subhumeral appendix short. Epipleuræ bistriate. Propygidium shining, very sparsely punctate, pygidium nearly smooth with very few punctures at the sides only. Anterior tibiæ feebly tridentate, apical tooth slightly bifid. Length .18 inch ; 4.5 mm.

Differs from the species with 4-striate elytra by its more oblong form, and by the presence of the very short humeral appendix. There is no apical subhumeral stria.

Pennsylvania and Illinois.

H. Haldemanni, Mars. Mon., 1860, p. 547, pl. 7, fig. 37.

From the description and comparisons made by Marseul, I cannot separate this species from *curtatus*. A verification of this must be made before placing this in synonymy.

H. defectus, Lec. Proc. Acad., 1859, p. 312 ; *permixtus*, Zimm. Trans. Am. Ent. Soc., 1869, p. 252.

Broadly oval. Inner thoracic stria entire, outer short apical. Elytra with four entire striæ, fifth short, apical, sutural half the length of the elytra, subhumeral entirely absent. Epipleuræ bistriate. Propygidium sparsely punctured, pygidium nearly smooth, and with a few punctures near the base and sides. Anterior tibiæ tridentate apical tooth deeply bifid. Length .12 inch ; 3 mm.

Very closely allied to the following species, and differs from *servus* by the short external thoracic stria.

Georgia and South Carolina.

H. indistinctus, Say. Journ. Acad., 1825, p. 35 ; Lec. Bost. Journ. V., p. 56, pl. 3, fig. 6 ; Mars. Mon., 1854, p. 574, pl. 10, fig. 137.

Thoracic striæ entire. Pygidium more distinctly punctured. Length .12–.14 inch ; 3–3.5 mm.

The above points are all those from which it differs from *defectus*.

North Carolina and Georgia.

H. servus, Er. Jahrb., 1834, p. 147 ; Mars. Mon., 1854, p. 561, pl. 9, fig. 126 ; Zimm. Trans. Am. Ent. Soc., 1869, p. 252.

Thorax with two entire striæ. Pygidium convex, coarsely and moder-

ately densely punctured, propygidium more coarsely and more densely punctured. Length .12–.14 inch ; 3–3.5 mm.

The species, otherwise than in the above noted characters agrees precisely with *defectus*.

Occurs in Maryland, South Carolina, Arizona, and in the West India Islands.

These last three species have the emargination of the mesosternum reduced to a minimum, so that they approach the next group in which the mesosternum is truncate.

Group *Bimaculatus*.

Mesosternum truncate in front. Epipleuræ narrow, unistriate, side pieces of meso- and metasternum grooved.

H. bimaculatus, Linn. Syst. Nat. 1, Vol. 11, p. 567; Lec. Bost. Journ. V., p. 59, pl. 4, fig. 1 ; Mars. Mon., 1854, p. 582, pl. 12, fig. 142 ; *obliquus*, Say. Journ. Acad.. 1825, p. 37.

Thorax with a broad shallow impression at the anterior angles within the stria. Side of thorax unistriate, stria fine and not entire. Elytra with five entire striæ, sutural stria extending in front of middle, subhumeral absent. Epipleuræ narrow unistriate, side pieces of meso- and metasternum with a broad moderately deep groove. Anterior tibiæ tridentate. Length .16 inch ; 4 mm.

The elytra are black with that portion external to a line drawn from the humerus to the tip of suture, red. The truncate mesosternum, narrow and unistriate epipleuræ, with the lateral groove of the thoracic side pieces, at once distinguish this from every other Hister in our fauna.

Occurs all over Europe and in the Middle States.

Group *Americanus*.

Mesosternum truncate, epipleuræ moderate, bistriate, side pieces of meso- and metasternum not grooved.

Elytra with two subhumeral striæ.
  Outer subhumeral entire ; thorax unistriate..... sedecimstriatus.
  Outer subhumeral short ; thorax bistriate..... ambigena.
Elytra without subhumeral stria.
  Elytra with five entire dorsal striæ.
    Thorax with two lateral striæ, outer short.
      Surface smooth..... americanus.
      Surface distinctly punctured..... perplexus.
    Thorax with the inner stria only..... exaratus.
  Elytra with four entire dorsals or less.
    Thorax with two lateral striæ, outer short.
      Four entire dorsal striæ. Epipleuræ bistriate.... nubilus.
      Three entire striæ, fourth short basal. Epipleuræ tristriate..... pollutus.
    Thorax with inner stria only.
      Four entire dorsal striæ. Epipleuræ bistriate... relictus.

H. sedecimstriatus, Say. Journ. Acad., 1825, p. 36; Lec. Bost. Journ. V., p. 57, pl. 3, fig. 9; Mars. Mon., 1854, p. 285, pl. 8, fig. 84.

Thorax with the internal lateral stria entire. Elytra with five entire striæ, deeply impressed, the fifth arching at base, and joining the sutural, two subhumeral striæ, outer entire, inner more deeply impressed terminating at humerus, but continued by the fine oblique humeral. Epipleuræ bistriate. Propygidium coarsely and sparsely punctured, pygidium nearly smooth, very minutely punctulate. Anterior tibiæ finely tridentate, apical tooth finely bifid. Length .16 inch; 4 mm.

Middle States and Canada. Abundant.

H. ambigena, Lec. Proc. Acad., 1859, p. 313.

Inner thoracic stria entire, outer abbreviated, extending nearly to the middle of thorax. Elytra with five entire striæ, fifth arching and joining the sutural, two subhumeral striæ, finely impressed, equal in length, and extending slightly in front of middle. Anterior tibiæ finely 4-dentate, apical tooth bifid. Propygidium and pygidium very sparsely and not coarsely punctured, the latter smoother at apex. Length .14 inch; 3.5 mm.

One specimen, Vermont.

H. americanus, Payk. Mon. p. 31, pl. 9, fig. 1; Lec. Bost. Journ. V., p. 56, pl. 3, fig. 7; Mars. Mon., 1854, p. 575, pl. 10, fig. 138.

Thorax with inner stria entire, outer abbreviated, rarely more than an arc at the anterior angle. Elytra with three entire striæ, fourth very slightly abbreviated, fifth curved at base and very rarely joining the sutural, striæ finely impressed. Upper surface smooth. Epipleuræ bistriate. Propygidium coarsely but sparsely punctured, pygidium more finely punctured and nearly smooth at apex. Anterior tibiæ tridentate, apical tooth prominent, and finely bifid at tip. Length .12–.16 inch; 3–4 mm.

Occurs abundantly from Canada to Georgia and Kansas.

H. perplexus, Lec. New Species, 1863, p. 61.

Closely allied to the preceding species, and differing in the following slight characters: Surface sparsely and finely punctured. Elytra with three entire striæ, fourth very slightly shorter, fifth equal to the fourth, and joining the sutural. Striæ rather strongly impressed and punctured. Length .16 inch; 4 mm.

As the specimens of this species are better developed than the preceding, it seems probable that they are mere local varieties.

Occurs in Canada, Middle States, Illinois and Wisconsin.

H. exaratus, Lec. Bost. Journ. V., p. 59, pl. 3, fig. 12.

Closely allied to *perplexus*, but differs as follows: Thorax with the inner stria only. Elytra with striæ finer. Surface not punctured. Length .14 inch; 3–5 mm.

One specimen, Georgia.

H. nubilus, Lec. Col. Kansas, 1859, p. 7.

Inner thoracic stria entire, outer very short apical. Elytra with four entire striæ, fifth short apical, sutural extending in front of middle. Epipleuræ bistriate. Propygidium sparsely punctured, pygidium more finely punctured and nearly smooth at apex. Anterior tibiæ finely 4-dentate, apical tooth slightly bifid. Length .18 inch ; 4.5 mm.

The fourth stria is so very slightly abbreviated at base that it may be called entire, as is also the same in the three preceding species.

Kansas.

H. pollutus, Lec. Col. Kansas, 1859, p. 7.

Closely resembles the preceding, and differs as follows : Outer thoracic stria extending beyond the middle of thorax. Fourth dorsal stria of elytra short basal. Epipleuræ finely tristriate. Length .18 inch ; 4.5 mm.

Kansas.

H. relictus, Mars. Annales, Belg. XIII, p. 89.

Lateral stria deeply impressed, slightly abbreviated at base, a slight impression within the angle at apex. Elytra with four entire punctured striæ, fifth and sutural abbreviated at basal end. Subhumeral wanting. Epipleuræ bistriate. Pygidium convex sparsely punctured, propygidium similarly, but more coarsely punctured. Anterior tibiæ with four fine teeth, the apical large and prominent. Length 4 mm. (.16 inch).

This species is known by the description only and from it the above extract has been made. Marseul compares this species with *corvinus*, which it resembles very closely, and is probably that cited by Zimmerman (Trans. Am. Ent. Soc., 1869, p. 252) as *corvinus*. The specimen on which the determination was made, does not appear in the cabinet of the latter author.

United States (Marseul), South Carolina (Zimm.).

Sub-genus *Phelister*.

Inner thoracic stria entirely absent, outer stria sometimes present, and then very close to margin. Tarsal grooves not limited on the outer side. Mesosternum prominent in front, prosternum at tip correspondingly emarginate. Hind tibiæ finely biseriately spinulose. Prosternum striate.

Prosternum between the striæ flat, striæ distant ; surface metallic.

Thorax without sub-marginal stria.

From oblong.....æneomicans.

Form broad..... venustus.

Prosternum between the striæ convex, striæ approximate ; surface piceous or black.

Thorax with distinct sub-marginal stria; five entire dorsals, subrotundus.

Thorax with no sub-marginal stria; four entire dorsal elytral striæ.

Pygidium smooth, very sparsely and finely punctulate vernus.

Pygidium densely punctulate..... Saunieri.

H. æneomicans, n. sp.

Oblong oval, subdepressed, surface brilliantly æneous, antennæ and legs rufous. Head sparsely punctured, front not concave supra-orbital striæ distinct. Thorax sparsely punctured on the disc, more coarsely at the sides, marginal stria entire. Elytra sparsely punctured at apex, humeral stria short, basal; dorsals 1–4 entire, fifth abbreviated at base, continued at apex by punctures, striæ punctured except the basal portion of the fourth; sutural stria short basal half wanting, apical portion continued by punctures. Propygidium coarsely punctured, pygidium more finely and less densely punctured. Anterior tibiæ sub-quadridentate, the upper tooth obsolete. Length .07 inch; 1.75 mm. Plate V., fig. 1.

This species is closely allied to *venustus*, from which it differs by its more oblong form, smaller size, front not concave, more deeply impressed elytral striæ and much more coarsely punctured thorax. The two species differ remarkably on comparison, and much more than the description would seem to indicate.

One specimen in the cabinet of Mr. Ulke, collected in the District of Columbia.

H. venustus, Lec. Ann. Lyc. V., p. 163; Mars. Mon., 1853, p. 468, pl. 14. fig. 1.

Oval, moderately convex, brilliant greenish-blue. Antennæ and legs reddish-brown. Front concave, coarsely and sparsely punctured. Thorax very finely and sparsely punctulate at middle, more coarsely toward the sides. Elytra at tip with a few coarse punctures, surface with four entire striæ, a very short humeral, fifth and sutural extending to middle. Propygidium coarsely and sparsely punctured, pygidium more densely and finely. Anterior tibiæ quadridentate, the second and third teeth more distant. Length .10 inch; 2.5 mm.

Marseul states that the hind tibiæ of this species have a single terminal spur, but two closely approximate spurs of equal length are distinctly visible with sufficient power.

One specimen has the fifth dorsal entire, but very fine at base.

Georgia, Louisiana and Texas, very rare.

H. subrotundus, Say. Journ. Acad., 1825, p. 39; Lec. Bost. Journ. V., p. 60, pl. 4, fig. 2; Mars. Mon., 1853, p. 487, pl. 14, fig. 19.

Broadly oval, black, shining, antennæ and legs reddish-brown. Front concave, sparsely punctured. Thorax finely punctulate on the disc, more coarsely at the sides. Marginal stria distinct, close to margin. Elytra with five entire striæ, sutural extending in front of middle. Propygidium sparsely punctured, pygidium nearly smooth, sparsely and minutely punctulate. Anterior tibiæ multidenticulate. Length .08–.10 inch; 2–2.5 mm.

Occurs over the entire country from Canada to Kansas, and southward to Georgia and Texas.

H. vernus, Say. loc. cit., p. 40; Lec. loc. cit. pl. 4, fig. 3; Mars. Mon., 1853, p. 478, pl. 14. fig. 11.

Closely allied to the preceding species, it differs by the absence of any marginal thoracic stria and by having four entire dorsal striæ only, to the elytra, the fifth and sutural extending from apex to middle. Length .08–.10 inch ; 2–2.5 mm.

Occurs with the preceding species.

H. Saunieri, Mars. Mon., 1861, p. 162, pl. 4, No. 15, fig. 6.

Differs from *vernus* by its stronger punctuation, and especially by the pygidium being densely punctured.

Found by Marseul near Rochester, New York. Unknown to us.

Sub-genus *Platysoma.*

Anterior tibiæ with tarsal groove deep, sinuate. Thorax without inner lateral stria. Prosternum without marginal line at apex. Middle and hind tibiæ dentate. Anterior tibiæ with inner margin straight, and without dentiform process near the base.

Body broad, not twice as long as wide, depressed ; elytra with not more than three entire dorsal striæ.

Anterior tibiæ 5-dentate sutural stria well marked..... carolinus.
Anterior tibiæ 4-dentate ; sutural obsolete or wanting.
Sides of thorax smooth.....aurelianus.
Sides of thorax punctured..... Lecontei.

Body elongate, more or less cylindrical, always as long or longer than twice the width. Elytra with more than three entire dorsal striæ.

Sutural stria entire.
All the dorsal elytral striæ entire ; sub-cylindrical ; mesosternal stria entire..... parallelus.
Fifth dorsal abbreviated at base ; depressed ; mesosternal interrupted..... æquus.
Sutural stria short, or at least, abbreviated.
Mesosternal stria entire.
Thorax evenly punctured ; fifth and sutural striæ long..... coarctatus.
Thorax smooth at middle ; fifth and sutural abbreviated ..... punctiger.
Mesosternal stria broadly interrupted..... basalis.

H. carolinus, Payk. Mon., p. 45, pl. 10, fig. 2 ; Lec. Bost. Journ. V., p. 39, pl. 1, fig. 3 ; Mars. Mon., 1853, p. 269, pl. 7, fig. 14 ; *sordidum,* Say. Journ. Acad., 1825, p. 44.

Broadly ovate, sub-depressed. Thorax with outer marginal stria entire ; surface smooth, impunctate. Elytra with three entire dorsal striæ, fourth and fifth apical, extending to middle, sutural somewhat longer. Propygidium coarsely and not very densely punctate, pygidium much more finely and sparsely punctured, nearly smooth at apex. Anterior tibiæ finely 5-dentate, second and third denticles more distant, middle tibiæ 4, hind tibiæ 3-spinous. Body black, shining, legs reddish-brown. Length .12 inch ; 3 mm.

Occurs from the Middle States to New Mexico.

H. Lecontei, Mars. Mon., 1853, p. 273, pl. 7, fig. 17; *depressus*, ‡ Lec. Bost. Journ. V., p. 40, pl. 1, fig. 4.

Slightly longer and more depressed than *carolinus*. Thorax smooth at middle, sparsely punctured at the sides, marginal stria entire. Elytra with three entire dorsal striæ, fourth apical, extending to middle sometimes very nearly entire, fifth short apical, sutural feeble equal to the fifth. Propygidium coarsely, but very sparsely punctured, pygidium coarsely punctured at base, more finely and sparsely at apex. Anterior tibiæ 4-dentate, middle 3-, apical 2-spinous. Length .10–.12 inch; 2.5–3 mm.

Occurs abundantly over nearly our entire territory. The specimens from California all differ from those of the Atlantic region by the entire obliteration of the frontal stria. As there are no other discoverable points of difference, I prefer to regard them merely as varieties.

H. aurelianus. n. sp.

Closely allied to *Lecontii*, but more depressed and differing as follows:

Thorax not punctured at the sides. Elytra with three entire dorsals, fourth very short, apical, fifth obsolete, sutural entirely absent. Length .12 inch; 3 mm.

Kindly presented to Dr. Leconte, by M. Sallé, who received it from the neighborhood of New Orleans, Louisiana.

The above three species have the mesosternal stria entire.

H. parallelus, Say. Journ. Acad., 1825, p. 42; Lec. Bost. Journ. V., p. 40, pl. 1, fig. 5; Mars. Mon., 1852, p. 264, pl. 7, fig. 9.

Moderately elongate, sub-cylindrical. Thorax sparsely and evenly punctured. Elytra with the five dorsal and sutural striæ entire, and with a short basal humeral stria. Pygidium and propygidium very coarsely, but sparsely punctured. Mesosternal marginal stria entire. Anterior tibiæ 4-dentate, apical tooth bifid, middle tibiæ 4-, posterior 2-spinous. Length .10 inch; 2.5 mm.

Occurs in Georgia, South Carolina and Florida.

H. æquus, Lec. New Species, 1863, p. 61; *frontalis*, ‖ Say. Journ. Acad., 1825, p. 43.

Closely allied to the preceding, but more depressed. Fifth dorsal stria always abbreviated at base. Mesosternal stria broadly interrupted at middle. Middle tibiæ 3-spinous. Length .08 inch; 2 mm.

Occurs in Georgia.

H. coarctatus, Lec. Bost. Journ. V., p. 41, pl. 1, fig. 6; Mars. Mon., 1853, p. 282, pl. 7, fig. 25.

Elongate parallel, cylindrical. Thorax evenly but not densely punctured. Elytra with four entire dorsal striæ, fifth three-fourths and sutural two-thirds the length of the elytra, a very short basal humeral. Propygidium coarsely, but sparsely punctured, pygidium finely, and very nearly smooth at apex. Mesosternal stria entire. Length .10–.12 inch; 2.5–3 mm.

Closely resembles *parallelus*, but is narrower and slightly more convex. Occurs with the *parallelus*. I have also seen a specimen from Canada.

H. punctiger, Lec. Proc. Acad., 1861, p. 343.

Thorax minutely punctulate on the disc, more coarsely punctured at apex and at the sides. Elytra with four entire dorsals, a trace of humeral, fifth extending to middle, sutural longer. Propygidium and pygidium coarsely and sparsely punctured. Mesosternal stria entire. Anterior tibiæ quadridentate, middle 4-, posterior 2-spinous. Length .14 inch ; 3.5 mm.

More robust than the preceding species, and differing more by its general aspect than by any well defined characters.

Occurs in California, Oregon and Nevada.

H. basalis, Lec. Proc. Acad., 1861, p. 343, note.

Closely allied in sculpture to *punctiger*, but more robust. Pygidium and propygidium more sparsely punctured, the former nearly smooth at apex. Mesosternal stria broadly interrupted at middle. Middle and hind tibiæ 3-spinous. Length .16 inch ; 4 mm.

Occurs in Ohio.

Sub-genus *Cylistix*.

Thorax with inner stria absent, outer stria entire and close to the margin. Anterior tibiæ with small dentiform process on the inner edge near the base. Prosternum convex, with a marginal stria continuing around the apex. Mandibles moderately prominent. Form cylindrical, elongate.

Marginal stria of prosternal lobe entire. Sutural stria entire.
  Hind tibiæ with two teeth at middle.....cylindricus.
  Hind tibiæ with one tooth at middle..... attenuatus.
Marginal stria of prosternal lobe broadly interrupted.
  Fifth dorsal and sutural striæ abbreviated at base.... gracilis.

H. cylindricus, Payk. Mon., p. 91, pl. 10, fig. 5 ; Lec. Bost. Journ. V., p. 42, pl. 1, fig. 8 ; Mars. Mon., 1853, p. 289, pl. 7, fig. 1 ; Lac. Atlas, pl. 17, fig. 2 ; ? *cylindricus*, Beauv. Ins., p. 178, pl. 6, b, fig. 1.

Elongate, cylindrical, black, shining. Legs reddish-brown. Head sparsely punctured, clypeus concave, the concavity extending in triangular form on the front. Thorax quadrate, sparsely punctured with moderate and fine punctures intermixed. Elytra with four entire striæ, fifth extending from apex to basal fourth, sutural entire. Propygidium and pygidium with very coarse and sparsely placed punctures. Anterior tibiæ 4-, middle 4-, posterior 3-dentate. Length .18 inch ; 4.5 mm.

Occurs from Massachusetts to Texas, not common.

H. attenuatus, Lec. Bost. Journ. V., p. 42, pl. 1, fig. 9 ; ? *elongatus*, Beauv. Ins., p. 178, pl. 6, b, fig. 2.

Closely allied to the preceding, but smaller and more slender. Fifth dorsal stria short, composed almost entirely of punctures. Anterior tibiæ 4-, middle 4-, posterior 2-dentate. Length .10–.12 inch; 2.5–3 mm.

Occurs in North Carolina and Georgia.

H. gracilis, Lec. Bost. Journ. V., p. 41, pl. 1. fig. 7; Mars. Mon., 1857, p. 405, pl. 11, No. 9, fig. 24.

Similar in aspect to *attenuatus*, but with the front less concave, sutural stria extending three-fourths, fifth stria extending to middle. Propygidium very sparsely punctured, pygidium nearly smooth. Marginal stria of prosternal lobe entirely obliterated. Anterior tibiæ 4-, middle 3-, posterior 2-dentate. Length .10–.12 inch; 2.5–3 mm.

Occurs in the Middle States.

TRIBALISTER, n. g.

Prosternum moderately lobed in front, lobe slightly depressed. Mesosternum truncate in front. Antennæ inserted under a slight frontal process, front joint moderate, joints of funicle gradually thicker, club gradually formed, solid, pubescent, oval and not truncate at tip. Antennal cavity in the anterior angle of the thorax between the dorsal and pectoral laminæ.

The solid club of this insect allies it not only with *Hetærius*, but also with *Scapicœlis*. In both these genera, however, the club is truncate, and in the former glabrous. The legs are those of *Phelister*, while the form of the body resembles *Tribalus*, inasmuch as the margins of the thorax and elytra are continuous and slightly reflexed. From *Scapicœlis* it differs not only in the form of the legs, but also in the construction of the first joint of the antennæ, which in the present genus is that which is usual in the Histeridæ, while in *Scapicœlis* the form is nearly that of *Echinodes*.

T. marginellus, Lec. Proc. Acad., 1859, p. 311.

Pale reddish-brown, smooth shining. Head shining, supra-ocular stria well marked, frontal stria obliterated, front slightly concave. Thorax twice as wide at base as long, sides feebly arcuate, anterior angles broadly rounded, disc moderately convex, smooth shining, margin slightly reflexed. Elytra as broad as long, moderately convex, smooth shining, apex slightly punctured, margin acute continuous with the thoracic and slightly reflexed, disc with four nearly entire striæ, the outer side of each elevated in the form of an acute carina, which is very strong at apex and gradually feebler to base, striæ gradually converging to apex, sutural stria simple extending from apex half to base, epipleuræ bistriate. Pygidium sparsely punctured, shining, propygidium more densely punctured. Prosternum flat, bistriate, stria obliterated at apex. Mesosternum with marginal line entire. Anterior tibiæ 5-denticulate, middle and hind tibiæ finely spinulose. Length .08 inch. 2 mm. Plate V., fig. 2.

The curious sculpture of the elytra of this insect has no parallel

among our Histeridæ, and will serve to make it known should the unique specimen before me be duplicated.

The affinities of this insect may be summed up as a Phelister with a gradually formed antennal club, the latter solid, oval, not glabrous, nor truncate, and with the elytral and thoracic margins continuous.

One specimen, Maryland.

EPIERUS, Er.

Antennæ inserted under the frontal margin, cavity at the anterior portion of prothorax, within the angle and partly concealed beneath by the pectoral plate, open in front and laterally.

Our species resemble each other closely, and are known by the following table:

Elytra with all the striæ entire.
- Epipleuræ deeply bistriate.... ..... regularis.
- Epipleuræ unistriate.
  - Pygidium finely rugulose, coarsely punctured..... novellus.
  - Pygidium smooth, finely punctured.
    - Body moderately convex; subhumeral sinuous.....pulicarius.
    - Body subdepressed; subhumeral straight..... ellipticus.

Elytra with the fifth dorsal and sutural abbreviated at base.
- Clypeus not tuberculate..... planulus.
- Clypeus with acute tubercle at middle of anterior margin.... nasutus.

E. coproides, Mars. is omitted in the above table as it is without doubt South American.

E. regularis, Beauv. Ins., p. 180, pl. 6, b, fig. 8; *nigrellus*, Say. Journ. Acad., 1825, p. 38; Lec. Bost. Journ. V., p. 62, pl. 4, fig. 5, Mars. Mon., 1854, p. 692, pl. 10, fig. 13; var *vicinus*, Lec. Ann. Lyc. V., p. 164; Mars. l. c., p. 693, pl. 10, fig. 14.

Oblong oval, black, shining, legs piceous. Head shining, minutely punctulate. Thorax not densely punctulate, punctures coarser and finer intermixed, both grades becoming rather coarser toward the base. Each elytron with six entire punctured striæ, intervals sparsely and minutely punctulate, subhumeral entire, rather deeply impressed, epipleural fold deeply bistriate and coarsely punctured. Propygidium with moderate punctures sparsely placed, pygidium minutely punctured. Length .08–.12 inch; 2–3 mm.

I am unable to find any differences whatever between the *regularis* and *vicinus*, the characters given by Marseul, vanishing entirely even in a small series.

Occurs in Georgia, Texas, Arizona and Southeastern California, under bark of trees, in the latter locality under cottonwood bark.

E. novellus, Zimm. Trans, Am. Ent. Soc., 1869, p. 253.

More elongate and parallel than the preceding species. Thorax more coarsely punctured. Elytral striæ entire, intervals sparsely punctulate,

subhumeral stria moderately impressed, inferior to the margin and slightly arcuate at basal end, epipleuræ unistriate, sparsely punctured. Propygidium and pygidium finely rugulose and coarsely, but sparsely punctured. Length .08 inch ; 2 mm.

One specimen, North Carolina.

E. pulicarius, Er. Jahr., 1834, p. 162 ; Mars. Mon., 1854, p. 705, pl. 10, fig. 25 ; *minor,* Lec. Bost. Journ. V., p. 73, pl. 4, fig. 6.

Oval, moderately convex, piceous black, shining. Thorax sparsely punctured. Elytræ with six entire striæ, subhumeral slightly inferior, epipleuræ finely unistriate, sparsely punctured. Pygidium minutely punctured, punctures at base coarser, propygidium sparsely and more coarsely punctured Length .06–.08 inch ; 1.5–2 mm.

Occurs in Florida, Georgia and Texas.

E. ellipticus, Lec. Proc. Acad., 1859, p. 313.

This species differs from *pulicarius,* by its broader and more depressed form. The subhumeral stria is marginal and straight, and not sinuous and inferior as in the preceding species. Length .10–.12 inch ; 2.5-3 mm.

Occurs in the Southern States.

E. planulus, Er. Jahr., 1854, p. 162 ; Mars. Mon., 1854, p. 702, pl. 10, fig. 22 ; *decipiens,* Lec. Ann. Lyc. V., p. 164.

Oblong oval, moderately depressed. Elytra with four entire dorsal striæ, fifth extending three-fourths to base, sutural extending slightly in front of middle, subhumeral inferior, slightly sinuous, epipleuræ unistriate sparsely punctured. Pygidium and propygidium sparsely punctured. Length .10 inch ; 2.5 mm.

Occurs near Fort Yuma, California.

E. nasutus, n. sp.

Almost precisely identical with *planulus,* and differing only in having a dentiform process from the clypeus at its middle slightly behind the anterior margin. Length .08–.10 inch ; 2–2.5 mm.

Occurs at Fort Yuma, and in Arizona, under Cottonwood bark.

Four specimens precisely identical, otherwise this character might be considered an accidental deformity.

Tribalus, Erichs.

Antennæ inserted under the margin of the front, club rounded, feebly truncate at tip. Antennal cavity at the anterior angle of the thorax between the dorsal and pectoral plates, open in front and laterally.

Two species occur in our fauna.

Pygidium oblique, elytra obsoletely striate..... americanus.
Pygidium inflexed, elytra with outer striæ of the elytra replaced by fine raised lines.....californicus.

T. americanus, Lec. Bost. Journ. V., p. 64, pl. 4. fig. 7 ; Mars. Mon., 1855, p. 159, pl. 9, No. 31, fig. 5.

Broadly oval, convex, black, feebly shining, rather densely punctured. Elytra with four dorsal striæ, the first and second apical, third and fourth basal. Pygidium and progygidium densely punctured, the former vertical. Thoracic and elytral margins continuous, and on both members slightly reflexed. Length .08–.10 inch; 2–2.5 mm.

This insect though not very common is contained in nearly all the collections, and may be readily known from all our Histeridæ by the generic characters, and the above short extract.

Occurs from Maryland to Texas and Illinois.

T. californicus, Horn, Trans. Am. Ent. Soc., 1870, p. 1, pl. 1, fig. 11.

Broadly oval moderately convex, feebly shining. Head and thorax coarsely but sparsely punctate. Elytral margin continuous with the thoracic and acute. Elytra with three entire fine raised lines, and a fourth abbreviated, extending from base to the middle of the elytra. Intervals obsoletely punctured. Body beneath sparsely punctate. Legs pale reddish-brown. Length .06 inch; 1.5 mm.

Occurs near Sacramento, California.

Notwithstanding the dissimilarity of this species and the preceding, I cannot find it generically different, even with the difference in the position of the pygidium.

T. lævigatus, Payk. (*lævissimus* Lec.), is West Indian and South American. Its reference to the United States is doubtless erroneous.

Onthophilus, Leach.

Antennæ inserted on the front immediately in front of the eyes. Club oval, annulate. Antennal fossa under the margin of the thorax behind the anterior angle, deep and closed in front, open beneath. Tibiæ slender, the anterior finely denticulate.

Two species only are known in our fauna.

Thoracic carinæ feeble, elytral carinæ equal, pygidium shining, surface even without carinæ ..... Lecontei.

Thoracic carinæ strong, elytral carinæ uneqal, pygidium and propygidium opaque, and with elevated lines ..... alternatus.

O. Lecontei, Horn, Trans. Am. Ent. Soc., 1870, p. 138, pl. 1, fig. 10.

Broadly oval, black, moderately shining. Head densely punctured, V-shaped carina feeble, front slightly concave. Thorax twice as wide at base as long, at apex broader than the length, sides gradually arcuate from base to apex, margin slightly reflexed; disc densely punctured, shining with six feeble carinæ, the middle two beginning at the apical margin, but not attaining the base, the second slightly abbreviated at apex and base, outer carinæ arcuate and abbreviated at apex and base; the four middle carinæ nearly equidistant. Elytra with six dorsal and a marginal entire carinæ, carinæ moderately elevated, intervals finely tri-carinulate, the middle carina of each interval interrupted by a row of coarse punctures. Epipleuræ coarsely punctured shining, limited above

by a sinuous elevated line. Propygidium transversely hexagonal, moderately shining, coarsely punctured, pygidium elongate oval, inflexed, more finely punctured than the propygidium and more shining. Length .16 inch ; 4 mm.

One specimen, Fort Tejon, California.

O. alternatus, Say. Journ. Acad., 1824, p. 46 ; Lec. Bost. Journ. V., p. 82, pl. 6, fig. 9 ; var. *pluricostatus*, Lec. l. c., p. 81 ; var. *nodatus*, Lec. l. c., p. 83 ; Mars. Mon., 1856, p. 558, pl. 11, No. 40, fig. 4 (*alternatus*) ; l. c. p. 556, fig. 3 (*nodatus*).

Broadly oval, very convex above, surface either moderately shining or opaque. Head with strong V-shaped carina, vertex slightly concave with short acute carina. Thorax twice as wide as long, disc coarsely punctured margins slightly reflexed, sides strongly arcuate, disc with six carinæ, the middle four entire, equidistant and slightly convergent to apex, outer carinæ short basal. Elytra carinate, carinæ variable in size. Epipleuræ coarsely foveatato-punctate. Propygidium coarsely punctate, with three longitudinal carinæ, the median entire, the lateral short. Pygidium coarsely punctured with two semicircular elevated lines at base and a longitudinal short carina at apex. Body beneath very coarsely punctate.

Var nodatus, Lec. Thorax with the sides more strongly arcuate. Elytra with three entire dorsal and a marginal, costæ ; intervals finely 5-carinulate, the third carinula slightly stronger, 2 and 4 interrupted by distant punctures. Length .10–.12 inch ; 2.5–3 mm.

Var. alternatus, Say. Surface more shining, thorax with sides less arcuate, third carinula stronger. Length .08 inch ; 2 mm.

Var. pluricostatus, Lec. Resembles *alternatus*, but less shining. Third carinula equal to the main carina. Length .08–.10 inch ; 2–2.5 mm.

I find it impossible with the series of specimens before me to separate, other than as varieties, the species above noted.

Occurs from Massachusetts to Georgia, but rare.

Hetærius, Erichs.

Anterior angles of thorax dilated.
  Legs, especially the posterior long..... morsus.
Anterior angles not dilated, thorax arcuately narrowed from base to apex.
  Lateral thickened margin of thorax with a transverse sulcus.....brunnipennis.
  Lateral thickened margin notched slightly behind the middle..... californicus.

H. morsus, Lec. Proc. Acad., 1859, p. 70 ; Horn, Trans. Am. Ent. Soc., 1870, pl. 1, fig. 6.

Ferruginous brown, feebly shining, very sparsely clothed with very

short bristly recumbent hairs, with a very few erect hairs more sparsely placed. Head concave, opaque. Thorax broader than long, on each side a broad oblique groove smooth at bottom, broader and deeper behind, disc of thorax (that is, the part between the grooves) truncate in front, arcuate at base and nearly twice as wide as apex, surface feebly shining, sparsely pubescent with recumbent bristle-like hairs; margin of thorax (part exterior to the grooves), divided behind the middle by a deep fossa into two portions, the posterior globular, the anterior of irregular pentagonal shape, the upper surface of which is flat, subopaque and pubescent. Elytra more shining than the thorax, less pubescent, with striæ indicated by finely elevated lines, of which the subhumeral and first dorsal are entire, the second dorsal three-fourths, and the third nearly two-thirds the length of the elytra. Propygidium transversely hexagonal, sparsely punctured, pygidium oval, longer than wide, minutely and very sparsely punctulate. Prosternum at tip deeply emarginate, marginal line scarcely evident, surface opaque; behind the lobe constricted and with a transverse impression, tip of lobe emarginate. Antennæ with first joint triangular, coarsely punctured, club not annulated, glabrous and truncate at tip. Anterior tibiæ gradually broader at basal third, then parallel to apex which is rounded, outer edge in its entire length minutely denticulate, tarsal groove straight and shallow; middle and hind tibiæ similar in form to the anterior, outer edge finely spinulose. Length .12 inch; 3 mm. Plate V., fig. 3.

In its general aspect, and by the length of the legs this species resembles the genus *Terapus*.

One specimen, Fort Tejon, California.

H. brunnipennis, Rand. Bost. Journ. II., p. 40; Mars. Mon., 1857, p. 433, pl. 11, No. 28, fig. 2; Horn, Trans. Am. Ent. Soc., 1870, pl. 1, fig. 8.

Pale chestnut brown, shining. Front slightly concave, shining. Thorax on each side with a groove parallel with the margin, disc smooth, shining, marginal space less shining and divided by a shallow transverse fossa slightly behind the middle, anterior angles obliquely truncate. Elytra with entire subhumeral stria, dorsal striæ as in *morsus*, but less distinctly defined by the elevated lines, and with erect fine hairs sparsely placed along the line of the striæ. Propygidium and pygidium as in *morsus*, but absolutely smooth and shining. Prosternum between the coxæ smooth and shining with an elevated marginal line. Tip of prosternal lobe emarginate. Legs similarly formed to *morsus*, but less elongate. Length .06 inch; 1.5 mm.

This is our nearest species to the *quadratus* of Europe, from which it abundantly differs by the transverse sulcus in the thickened margin.

Occurs in the Middle States and Illinois.

H. californicus, Horn, Trans. Am. Ent. Soc., 1870, p. 137, pl. 1, fig. 7.

Head shining, pubescent. Thorax nearly twice as wide at base as

long, lateral sulci moderate anteriorly, deep and broad at base, margin convex, shining with a constriction slightly behind the middle ; sides of thorax pubescent. Elytra with three entire dorsal striæ and subhumeral entire. Pygidium and propygidium smooth shining. Prosternum between the coxæ narrow with elevated marginal line meeting in front above the middle of prosternum. Prosternal lobe in front feebly emarginate. Length .08 inch ; 2 mm.

Collected at Sonoma, California.

Echinodes, Zimm.

Prosternal lobe elongate, broad and slightly deflexed. Antennæ with the first joint elongate truncate at tip and concealing the joints of the funiculus when viewed from the front, second joint inserted near the base of the first, club elongate oval, glabrous, truncate at apex.

E. setiger, Lec. Proc. Acad., 1859, p. 316 ; Zimm. Trans. Am. Ent. Soc., 1869, p. 253.

Broadly oval, moderately convex, rufo-piceous, moderately shining. Front obtusely carinate and with a transverse groove at the base of clypeus. Clypeus moderately prominent, narrow at base, dilated toward apex and acutely emarginate, on each side of base of clypeus a short acute process. Thorax nearly three times as wide at base as long, apex moderately emarginate, base arcuate, sides moderately arcuate and gradually narrowing to apex. Surface shining with sparsely placed fine setigerous punctures, at sides with fine stria close to the margin. Elytral margin continuous with the thoracic, acute nearly to apex and with six dorsal and a sutural stria replaced entirely by punctures, the two outer stria with the punctures in a double series, those of the inner rows gradually more confused and broader, each puncture setigerous, intervals smooth shining. Propygidium and pygidium coarsely but sparsely punctured, each puncture bearing a short seta. Prosternum at tip emarginate, bistriate, striæ divergent at tip, and continuing to the base of lobe. Lobe broad, deflexed, smooth. Mesosternum produced at middle. Tibiæ elongate oval, finely spinulose on the outer margin. Entire length .06 inch ; 1.5 mm. Plate V., fig 4.

Resembles *Eretmotus* in the form of the antennæ and somewhat in the form of the legs, but differs abundantly from all the *Hetærius*-like genera by the broader and longer prosternal lobe. The peculiar sculpture of the head recalls that of some species of *Dyschirius* in the mode of its formation.

Rare in South Carolina and Georgia, occurs with a pale species of Ant, the name of which is unknown to me, and which has the metathoracic segment bispinous, and the first two segments of the abdomen slender and gibbous above.

PAROMALUS, Erichs.

The antennal club is received in a cavity at the middle of the prothoracic parapleuræ.

The species are thus distinguished :

Form strongly depressed, elytra without entire striæ. Prosternum bistriate.
  Third dorsal stria strongly impressed, more than one-third the length of elytron..... æqualis.
  Third dorsal stria obliterated or existing in a mere trace..... estriatus.
Form moderately convex, elytra striate. Prosternum bistriate.
  Fourth dorsal stria joining the sutural by an arc; subhumeral very short or obsolete.
    Elytra normally striate, intervals flat..... conjunctus.
    Elytra with deeply impressed striæ, intervals concave..... geminatus.
  Fifth dorsal or none joining the sutural, fourth not arched.
    Surface metallic. Subhumeral stria entire, fifth dorsal abbreviated..... mimeticus.
    Surface not metallic, black or piceous.
      Subhumeral stria entire.
        Form oval, moderately convex.
          Fifth dorsal stria entire.
            Sutural stria entire, joining the fifth...quatuordecimstriatus.
            Sutural stria abbreviated..... lautus.
          Fifth dorsal continued by distant punctures.
            Sutural stria abbreviated..... opuntiæ.
        Form parallel, subcylindrical..... tejonicus.
      Subhumeral short, apical, sometimes wanting.
        Form broadly oval, convex.
          Subhumeral distinct at apex; a short outer subhumeral..... consors.
          Subhumeral entirely obliterated..... gilensis.
        Form oblong strongly depressed.
          Subhumeral abbreviated at base and apex..... tenellus.
Form convex, elytra without entire striæ, prosternum not striate, anterior tibiæ minutely 4-dentate.
  Form oblong, subdepressed, marginal stria of mesosternum visible at middle..... bistriatus.
  Form oval, convex, mesosternal stria broadly interrupted..... seminulum.

P. æqualis, Say. Journ. Acad., 1825, p. 41; Lec. Bost. Journ. V, p. 63, pl. 4, fig. 9; *affinis*, Lec. loc. cit. fig. 10; Mars. Mon., 1855, p. 108, pl. 8, figs. 1, 2.

Sub-elliptical, piceous shining, strongly depressed, surface sparsely and finely punctulate. Elytra with deep oblique humeral stria, first dorsal visible at middle only and usually deep, second extending from apex to beyond the middle, third stria basal, short. Propygidium finely and sparsely punctulate. Pygidium coarsely sculptured, cicatrix like ♂, smoother and much less rugose ♀. Anterior tibiæ 5-dentate. Length .10–.12 inch; 2.5–3 mm.

I have united the species *affinis*, Lec. to that of Say, as there does not appear to exist between them any point of difference. The form of the two is precisely identical, the difference in this respect indicated by Marseul being rather sexual than specific; the striæ vary greatly in the degree of impression, and by this, two forms might be selected as types of the two species between which very few individuals would form a perfect series. A glance at the figures by Marseul and Leconte will show the propriety of placing the two as synonymous.

Occurs from Canada to Georgia.

P. estriatus, Lec. Proc. Acad., 1859, p. 314.

Slightly more convex than *æqualis* and differs in its sparser and finer punctuation and by all the striæ obliterated with the exception of a faint trace of the second at apex and the third at base. Length .10 inch; 2.5 mm.

I have also considerable doubt as to the propriety of retaining this species as distinct, but the total obliteration of the first dorsal stria with the somewhat more convex form have induced me to retain it until intermediate forms present themselves.

Occurs from Canada to Louisiana.

P. conjunctus, Say, Journ. Acad. 1825, p. 38; Lec. Bost. Journ. V, p. 68, pl. 5, fig. 1; Mars. Mon. 1855, p. 89, pl. 8, No. 22, fig. 2.

Oval, moderately convex, black, shining. Thorax finely punctulate, punctures at the sides more distinct. Elytra with a very short and fine subhumeral stria at apex, dorsals 1-4 entire, punctured, the fourth broadly arching at base and joining the sutural, fifth stria extending in front of middle. Propygidium moderately punctured, pygidium shining, sparsely and minutely punctulate. Anterior tibiæ bidentate. Length .10 inch; 2.5 mm.

Occurs in the Gulf States.

P. geminatus, Lec. Proc. Acad., 1859, p. 314.

Similar in form to the preceding, but less shining. Elytra with the subhumeral stria fine, extending from apex three-fourths to base, dorsals 1-4 entire, the latter arching at base to join the sutural, fifth stria abbreviated at base, striæ deeply impressed, intervals slightly concave. Propygidium rather coarsely but sparsely punctured, pygidium nearly

smooth, very sparsely and minutely punctulate. Anterior tibiæ bidentate and above the upper tooth minutely denticulate. Length .08–.10 inch; 2–2.5 mm.

The peculiar striation of the elytra at once distinguishes this species from all others in our fauna.

Occurs in Middle States and Illinois.

P. mimeticus, n. sp.

Oblong oval, sub-depressed, surface brilliant metallic blue, legs and antennæ piceous, under surface black. Head feebly convex, sparsely punctured. Thorax equally punctured with moderate punctures with coarser punctures intermixed at the sides. Elytra sparsely punctulate, more evidently punctured at apex, subhumeral stria entire, dorsals 1–4 entire, finely punctured, fifth abbreviated at base, sutural replaced by punctures which extend slightly in front of middle. Propygidium and pygidium sparsely and finely punctured. Prosternal striæ well impressed, mesosternal stria entire. Anterior tibiæ bidentate and multidenticulate above the upper tooth. Length .06 inch; 1.5 mm. Plate V., fig. 5.

Closely allied to *æneicollis* and *dominicanus*, and differs from the first by the abbreviated fifth dorsal, and from the latter by the entire stria of mesosternum.

One specimen in cabinet of Mr. Ulke, collected in Arizona.

P. quatuordecimstriatus, Steph. Illust. Brit. Ent. V., 1832, p. 412; *nana*, Lec. Bost. Journ. V., p. 71, pl. 4, fig. 4.

Oblong oval, convex, piceous black, shining, antennæ and legs reddish-brown. Thorax sparsely punctulate, punctures at the sides coarser. Elytra with the subhumeral stria entire, striæ 1-5 entire, punctured, the fifth slightly arching at tip, and joining the entire sutural. Propygidium and pygidium sparsely punctured, the latter much more finely and sparsely. Anterior tibiæ bidentate. Length .08–.10 inch; 2–2.5 mm.

This species occurs in many parts of the world, and it is found in our own country from the Middle States to Georgia.

P. lautus, Zimm. Trans. Am. Ent. Soc., 1869, p. 253.

More elongate and convex than the preceding species. Thorax sparsely punctured, punctures moderately coarse and evenly distributed over the entire surface. Subhumeral stria entire, dorsals 1–5 entire, sutural abbreviated at base and not joining the fifth dorsal. Pygidium and propygidium sparsely and finely punctulate. Anterior tibiæ bidentate. Length .06 inch; 1.5 mm.

Occurs in North Carolina.

P. opuntiæ, Lec. Am. Lyc. V., p. 164.

Oblong oval, moderately convex, piceous black, shining. Thorax very minutely and sparsely punctulate, punctures more evident at the sides. Elytra with the subhumeral stria straight and entire, dorsals 1–4 entire, fifth abbreviated at base and continued by punctures and gradually converging toward the sutural which is also similarly abbreviated. Propy-

gidium moderately, coarsely and sparsely punctured, pygidium minutely punctulate. Anterior tibiæ bidentate. Length .10–.12 inch; 2.5–3 mm.

Occurs at San Diego in decomposing Opuntia.

P. Tejonicus, n. sp.

Oblong, parallel, subcylindrical, piceous, legs and antennæ reddish-brown. Head sparsely punctulate, frontal stria obsolete. Thorax broader than long, slightly narrower in front, sides feebly arcuate, surface rather coarsely but sparsely punctured, marginal stria fine, entire. Elytra parallel, longer than wide conjointly, surface sparsely punctulate, subhumeral stria fine, entire, dorsals 1–5 entire, sutural more deeply impressed, abbreviated at apex and base. Propygidium coarsely and moderately densely punctured, pygidium more finely and less densely punctured. Prosternum bistriate striæ joining at tip. Mesosternum with marginal stria entire. Anterior tibiæ finely 4-dentate, middle tibiæ with two subapical, and a supra median spinule, hind tibiæ with two subapical spinules. Length (entire) .06 inch; 1.5 mm.

This insect resembles to a remarkable extent some of the species of Platysoma or Cylistix.

One specimen, Fort Tejon, California.

P. consors, Lec. Ann. Lyc. V., p. 164; Mars. Mon., 1855, p. 88, pl. 8, No. 22, fig. 1.

Resembles *opuntiæ*, and differs in having the inner subhumeral stria abbreviated at base, and a short outer subhumeral visible at the middle of the sides only. The fifth dorsal and also the sutural are also more decidedly obliterated at basal end. Length .08–.10 inch; 2–2.5 mm.

Occurs with the preceding, and extends its habitat southward into Mexico, etc.

P. gilensis, Lec. Ann. Lyc. V., p. 164.

Closely resembles *consors*, but differs in having the subhumeral striæ entirely obliterated. Length .08–.10 inch; 2–2.5 mm.

Occurs in the valley of the Gila River, Arizona.

This species is not synonymous with *P. tenellus*, Er., as stated by Marseul.

P. tenellus, Er. Jahrb., 1834, p. 170; Mars. Mon., 1855, p. 94, pl. 8, No. 22, fig. 7; *corticalis*, Lec. Ann. Lyc. V., p. 163.

Oblong oval, depressed. Elytra with four dorsal striæ entire, fifth and sutural abbreviated at base, subhumeral very short, faintly impressed, abbreviated at apical and basal extremities. Propygidium coarsely, pygidium very finely punctulate. Length .06–.08 inch; 1.5–2 mm.

The species which we have long known as *corticalis*, Lec., agrees perfectly with the description and figure of Erichson's *tenellus*, and it is probably by an accidental error that the preceding species was placed as the synonym.

Occurs along the borders of the Colorado River, California, under bark.

P. bistriatus, Er. Jahrb., 1834, p. 171; Lec. Bost. Journ. V., p. 67. pl. 4, fig. 11; Mars. Mon., 1862, p. 26; 1861, pl. 15, No. 25, fig. 8.

Oblong oval, sub-depressed, piceous black, shining, antennæ and legs reddish-brown. Head sparsely punctured, frontal stria entire. Thorax moderately coarsely but sparsely punctured, marginal stria entire. Elytra more coarsely and sparsely punctured than the thorax, first and second striæ short basal, sutural entirely absent. Propygidium finely and sparsely punctured, pygidium more densely. Prosternum not striate. Marginal line of mesosternum distinctly impressed at middle. Anterior tibiæ finely 4-denticulate. Length .08 inch; 2 mm.

Occurs in the Middle States and Kansas.

P. seminulum, Er. Jahr., 1834, p. 171; Lec. Bost. Journ. V., p. 67, pl. 4, fig. 12; Mars. Mon., 1855, p. 120, pl. 8, No. 23, fig. 12.

Oval, moderately convex, piceous, shining. Head sparsely punctulate, frontal stria entire. Thorax sparsely punctulate, marginal stria entire. Elytra more coarsely punctured than the thorax, disc with traces of two striæ at base and a short faintly impressed sutural. Propygidium and pygidium punctulate, the latter more densely and finely. Prosternum with the striæ obsolete. Marginal stria of mesosternum broadly interrupted at middle. Anterior tibiæ finely 4-denticulate. Length .08 inch; 2 mm.

Closely allied to the preceding but the more oval and convex form as well as the presence of sutural stria at once distinguish it.

Occurs from Middle States to Texas.

Dendrophilus. Leach.

Antennal fossa under the side of prothorax near the middle, broadly open, pectoral plate broadly incised. Tibiæ moderately dilated, outer margins finely denticulate. Spur of anterior tibiæ large.

D. punctulatus, Say. Journ. Acad., 1825, p. 45; Lec. Bost. Journ. V., p. 65, pl. 4, fig. 8; Mars. Mon., 1857, p. 435, pl. 11, No. 30.

Piceous black, oval, moderately convex, shining. Head finely punctulate. Thorax sparsely and evenly punctulate, marginal line wanting in front, finely impressed at basal end. Elytra sparsely punctured, punctures denser toward the apex, outer subhumeral entire, deeply impressed, inner sub-obsolete; dorsal striæ 1-2 nearly entire, 3–4 gradually shorter, basal, sutural entirely wanting. Epipleuræ punctured. Progygidium very short, sparsely and finely punctulate, pygidium oval, vertical, feebly convex near the sides slightly concave, coarsely and rather densely punctured. Mesosternum deeply emarginate, without stria. Prosternum on each side striate, apex rounded, lobe short. Tibiæ similarly dilated, outer edge finely denticulate. Length .12 inch; 3 mm.

Occurs in the Middle States region, under bark.

ANAPLEUS, n. g.

Form broadly oval, convex. Head small, retracted, front slightly concave, clypeus not distinct. Antennæ frontal, inserted above the base of the mandibles, first joint moderately long, second half the length of the first, joints 3–7 small, sub-globular, equal, club suddenly formed, elongate oval, distinctly annulate. Antennal fossa in the middle of the under side of prothorax, broadly open, pectoral plate incised. Thorax without marginal stria. Scutellum very small, triangular. Elytra acutely margined. Abdomen invisible from above. Pygidium vertical or feebly inflexed. Prosternum broad, bistriate, apex feebly emarginate, lobe short sub-truncate, Mesosternum feebly prominent in front. Anterior tibiæ slightly arcuate, feebly dilated, middle and hind tibiæ slender. Tibial spurs minute.

From the insertion of the antennæ, this genus must be placed near *Dendrophilus* from which it differs by its slender middle and hind tibiæ, its shorter prosternal lobe, the mesosternum rounded in front, and many other points. From *Bacanius* it differs notably in the presence of scutellum, and from *Sphærosoma*, in which the species has been placed by the form of the antennal cavity and the form of the antennæ themselves.

A. marginatus, Lec. Proc. Acad., 1853, p. 292.

Broadly oval, regularly convex, piceous, subopaque. Head coarsely punctured, front concave. Thorax coarsely and rather densely punctured especially at base. Elytra coarsely punctured much less densely and more coarsely than the thorax, margin acute slightly reflexed, and continuous with the thoracic margin, disc with traces of the third dorsal stria at base. Propygidium short, invisible from above sparsely punctured, pygidium vertical more sparsely punctulate. Epipleural margin of elytra broad with a fine, entire line at middle. Prosternum as broad as long, on each side striate, surface moderately convex coarsely, but very sparsely punctured, lobe short sub-truncate at apex. Mesosternum broad, anteriorly rounded, surface very sparsely punctured and without striæ. Anterior tibiæ slightly arcuate, slender at base and feebly dilated toward the middle, and less dilated at apex, outer margin simple, middle and hind tibiæ slender. Spurs of anterior tibiæ minute, of middle and hind tibiæ not visible, perhaps wanting. Length .06 inch ; 1.5 mm.

The appearance of this insect is that of *Tribalus*. As in Dendrophilus the under side of the prothorax is entirely excavated and receive not only the antennæ, but also the femur and tibiæ in repose.

Occurs in Illinois and District of Columbia (Ulke).

Sub-tribe, SAPRINI.

The genera of this tribe are fewer in number than the preceding and more readily distinguished.

Antennal cavities at the sides of the prosternum. Antennæ inserted under the frontal margin..... SAPRINUS.
Antennal cavities on the under side of prothorax in front of the coxæ. Antennæ frontal.
Eyes finely granulated, not prominent.
Thorax without deep lateral groove.
Tibiæ toothed. Pygidium regularly convex..... TERETRIUS.
Tibiæ spinulose. Pygidium double..... ....TERETRIOSOMA.
Thorax with deep lateral groove. Prosternum deeply bisulcate, body oblong. Tibiæ not toothed..... PLEGADERUS.
Eyes coarsely granulated and very convex.
Hind tarsi five-jointed. Scutellum invisible..... BACANIUS.
Hind tarsi four-jointed.
Scutellum distinct..... ACRITUS.
Scutellum invisible..... AELETES.

Bacanius has been removed from the preceding sub-tribe and placed near Acritus with which it appears to have many points of resemblance. The eyes of the last three genera are rounder and more convex than is usual in the entire family and very coarsely granulated. The scape of the antennæ is lodged in a deep groove immediately in front of the eyes, which are not bordered by a narrow corneous band in front. The deep groove adds still further to the apparent convexity of the eyes.

SAPRINUS, Leach.

The arrangement of the species of this genus in groups, adopted by Dr. Leconte (Proc. Acad. VI., p. 40), appears to afford the most natural method of their subdivision and is, at the same time founded on characters which are much the least variable of any that can be made use of. With some slight modification to avoid the use of the epipleural striæ, the following system is identical, and the groups here retained are equivalent to those already established.

Front not margined.
Hind tibiæ more slender than the middle tibiæ and at apex narrower than at middle, outer edge and apex not spinulose..... Group, I.
Hind tibiæ as broad or broader than the middle, at apex always broader, outer edge spinulose.
Prosternum flat, striæ horizontal and united in front.... Group, II.
Prosternum at least moderately convex.
Prosternum without striæ..... Group, III.
Prosternum distinctly striate.
Striæ parallel, horizontal, abbreviated in front..... Group, IV.
Striæ divergent and ascending.
Prosternum moderately convex.
Prosternum anteriorly not foveate..... Group, V.
Prosternum foveate..... Group, VI.
Prosternum compresso-carinate..... Group, VII.

Front distinctly margined.

Prosternum compressed, striæ entire or nearly so, convergent in front.

Hind tibiæ biseriately and usually finely spinulose..... Group VIII.

Prosternum compresso-carinate, striæ short, united in front, sometimes entirely absent.

Hind tibiæ at least triseriately often confusedly spinulose, spinules robust and frequently very short..... Group, IX.

In the above scheme *Gnathoncus* and *Pachylopus* have been included as synonymous with *Saprinus*.

Group I.

Species of moderately robust form. Front anteriorly not margined, head with distinct supra-orbital stria extending to, and slightly on the margin of the front. Thoracic margin fimbriate. Prosternum moderately elevated, feebly convex but narrow at its summit; striæ following the slight curve of the prosternum, not ascending, broadly divergent at base, slightly divergent in front, nearly attaining the front margin of the prosternum, but not terminating in a fovea. Hind tibiæ more slender than the middle tibiæ, gradually but feebly broader from base to a little beyond the middle, then narrowed to apex, hinder margin not spinulose.

By these characters a California species may readily be separated from all our other Saprinus. The epipleural fold is also tristriate, but this character is difficult to appreciate, and is moreover uncertain in its existence.

S. discoidalis, Lec. Ann. Lyc. V., p. 167; Mars. Mon., 1855, p. 375, pl. 16, fig. 25.

Black with tinge of violet. Head sparsely and finely punctulate. Thorax at sides coarsely and densely punctured, disc smooth and shining. Elytra with the first dorsal entire, second, third, and fourth extending slightly beyond the middle and gradually obsolete, the fourth at base slightly arched, but not joining the sutural which is slightly abbreviated at base, but extends to apex and thence along the edge of the elytron to the marginal; internal subhumeral not joining the humeral, external subhumeral short, distinct at humerus only. Surface shining with an opaque space, sparsely punctured, enclosed between the first and fourth striæ extending from base to apex, and narrowly along the apex to the suture, enclosing a smooth space on the third and fourth interspaces one-fifth from the base of the elytra; discal space smooth, lateral region shining, sparsely punctulate. Propygidium and pygidium finely and rather densely punctured. Marginal stria of mesosternum entire, surface smooth. Anterior tibiæ multidenticulate, middle tibiæ uniseriately strongly spinulose, hind tibiæ mutic. Length .16-.26 inch; 4–6.5 mm.

Occurs in Owen's Valley and San Diego, California, and also in Arizona.

Group II.

Front not margined, middle and hind tibiæ similar in form and spinulose. Prosternum horizontal, summit flat, striæ converging and united in front.

The following species are contained in this group:

Sutural stria very short, basal, not joining the fourth dorsal by an arc.
  Antennal fossæ narrowing the prosternum in front..... rotundatus.
Sutural stria entire or nearly so, arching with the fourth dorsal; antennal fossæ not narrowing the prosternum.
  Dorsal striæ normal; elytral sparsely punctured at apex.
    Front without supra-orbital stria; anterior tibiæ multidenticulate..... Behrensii.
    Front with supra-orbital stria; anterior tibiæ coarsely dentate..... planisternus.
  Third dorsal entirely absent, elytra at apex densely strigoso-punctate abruptly limiting the discal space.... rugipennis.

S. rotundatus, Kugel. Schneid. Mag., p. 304; Mars. Mon., 1855, p. 503, pl. 19, fig. 119; *deletus*, Lec. Bost. Journ. V., p. 74, pl. 5, fig. 11; *var. communis*, Mars. Mon., 1862, p. 501, pl. 17, IV., fig. 4; *var. interceptus*, Lec. Ann. Lyc. V., pp. 166 and 216.

Piceous or black, shining, legs brownish-red. Head sparsely punctulate. Antennæ brownish-red. Thorax coarsely punctate and with a slight ante-scutellar impression. Elytra with the first dorsal stria entire, but very fine beyond the middle, second and fourth equal, not extending beyond the middle, third somewhat longer, fourth slightly arcuate at base, fifth represented by a very short arc sometimes uniting the fourth dorsal and sutural, the latter always very short, basal, never extending beyond the basal fourth; subhumeral of variable length not joining the humeral; epipleural fold with three feeble striæ; surface sparsely punctured, punctures finer toward the sides and base. Pygidium and propygidium moderately punctured. Prosternum strongly narrowed in front, striæ gradually convergent, and uniting at the tip. Anterior tibiæ 5-denticulate, the second and third teeth more distant than the others, middle and hind tibiæ uniseriately spinulose, the latter the more finely. Length variable, .10–.14 inch; 2.5–3.5 mm.

Var. interceptus, Lec. Elytral punctures coarser and apparently denser.

Var. communis, Mars. Punctures of the elytra more generally diffused, and more distinct in the sub-scutellar region, striæ somewhat more distinctly impressed.

I have before me a specimen of *rotundatus* from Europe, and it is from an examination of this, and a comparison of the other two forms that I feel compelled to unite them as mere varieties. In fact the variation

here is not nearly so great as has been long known in *pensylvanicus* and *lugens*.

The forms identical with the European occur in the entire Atlantic region, and also in California; *communis* is Canadian, and *interceptus* from California and Oregon. An examination of Marseul's type of *communis* convinces me of the absolute identity of it with *rotundatus*.

S. Behrensii, n. sp.

Broadly oval, piceous black, shining. Antennæ and legs reddish-brown. Head finely punctulate. Thorax sparsely punctulate, punctures at sides denser and toward the base coarser. Elytra with the first dorsal extending three-fourths the length of the elytra, second, third and fourth equal extending beyond the middle, the fourth broadly arching at base and joining the sutural which extends nearly to the apex, subhumeral obsolete, humeral distinct and close to the first dorsal; epipleural fold with two striæ finely impressed; surface moderately coarsely but sparsely punctured at the apical third, the punctures not extending beyond the first dorsal, and at the suture extending slightly in front of middle. Pygidium and propygidium moderately punctured. Prosternal striæ strongly convergent in front and uniting before the apex, prosternum not narrowed in front and on each side a small fovea. Anterior tibiæ finely multidenticulate, middle and hind tibiæ uniseriately spinulose. Length .14 inch; 3.5 mm.

The appearance of this species agrees with Group IV., but the converging and united striæ forbid its position in this group. The prosternum in front is not narrowed as in its preceding species. This narrowing is caused by the extension of the antennal fossa, which thus becomes more anterior in *rotundatus* than in any other species of the genus. The genus *Gnathoncus* proposed by Duval for the species allied to *rotundatus* does not seem worthy of being retained. This species was sent me by Mr. Jas. Behrens from San Diego, California.

S. planisternus, Mars. Mon., 1862, p. 477, pl. 12, fig. 36.

Oval, moderately convex, surface shining, with distinct bronze lustre, legs brownish. Head sparsely punctulate. Thorax with the margin smooth, a short submarginal stria beginning in a shallow fossa near the anterior angle, and within the stria the surface sparsely punctured. Elytra sparsely punctured at apex beyond the tips of the striæ and near the suture; subhumeral striæ entirely absent, oblique humeral very fine; first dorsal extending slightly beyond the middle, 2–3–4 subequal extending to three-fourths, fourth dorsal arching at base joining the sutural which is entire. Propygidium and pygidium sparsely punctured, the latter more finely. Anterior tibiæ with the apical three teeth coarse, the upper three finer, middle and hind tibiæ spinulose. Prosternal striæ gradually convergent and uniting in front near the tip of the prosternum. Length .15 inch; 3.75 mm.

This species is one of the most distinct in our fauna. The thoracic sculpture is peculiar. Near the apical angle and equi-distant from the

apical margin and sides is a slight fossa from which extends posteriorly a short stria, within which especially in front is a punctured space. The figure given by Marseul is very characteristic.

The type of this species was kindly loaned by M. Chevrolat, through the intervention of M. Aug. Sallé.

No special locality for its occurrence is known; probably Texas.

S. rugipennis, Mars. Mon., 1855, p. 417, pl. 16, fig. 51.

Oval moderately convex, piceous, shining. Head sparsely punctured, supra-orbital stria entire, extending on the sides of the epistoma. Thorax with a narrow space of coarse punctures along the lateral margin, a few punctures at the sides of the base and a slight ante-scutellar impression. Elytra at apex densely strigoso-punctate and opaque, punctured space terminating abruptly in front, extending along the space between the first and second striæ by sparse punctures to base and also to the extreme margin at the apex; external subhumeral stria indistinct, internal moderately long, oblique humeral finely impressed; first dorsal short feebly impressed, second extending nearly to middle, third entirely obliterated except a rudiment at base, fourth dorsal as long as the second arching at base, joining the sutural which is entire. Propygidium and pygidium moderately densely and coarsely punctured. Prosternum horizontal, striæ convergent and uniting in front. Anterior tibiæ 5–6 denticulate, middle and hind tibiæ spinulose. Length .14 inch; 3.5 mm.

This species at first sight has the aspect of relationship with *vitiosus*, Lec., but the form of the prosternum and the arrangement of the striæ absolutely forbid any such reference. The group is, as at present constituted, rather heterogeneous in aspect and might be divided into those species with the prosternum not narrowed in front by the prosternal fossæ, and those in which it is so narrowed, although such a course is at present unnecessary.

The unique before me (the type) was kindly loaned by Marseul, and is said to be from America. I introduce it in our fauna, that attention may be directed to it as its general aspect is that of a southern California species.

Group III.

Prosternum transversely convex, longitudinally very feebly sinuous anteriorly truncate, striæ entirely wanting. Front not margined.

S. interstitialis, Lec. Ann. Lyc. V., p. 166.

Oblong, piceous black, surface with slight bronze lustre. Head densely punctured, supra-orbital stria wanting. Thorax with the disc nearly smooth, at base narrowly, and at apex and with a broad space punctured, punctures denser at the margins and gradually finer toward the centre. First dorsal stria of elytra extending to middle, 2–3-4 sub-equal and longer, the third stria double, fourth dorsal broadly arching at base and joining the sutural which is nearly entire, internal subhumeral obsolete,

humeral short, external subhumeral very short, basal, and close to the marginal stria, marginal stria strongly impressed, epipleural obsolete; surface between the striæ 1–4 sparsely punctured from the base, becoming gradually more dense toward the apex and forming a narrow space along the apex. Pygidium and propygidium moderately punctured. Anterior tibiæ 5-dentate, middle and hind tibiæ uniseriately spinulose. Mesosternal stria obsolete anteriorly. Length .12 inch; 3 mm.

The elytral punctures extend not only in the space indicated, but also along the suture and base, the sides of the elytra beyond the first stria are nearly smooth. The smooth space between the fourth dorsal and sutural is of oblong form and on each elytron more than twice as wide as long. One specimen in my cabinet has the third elytral stria single and not duplicated as in the type, and this character is not of specific value.

This species is thus far rare in California. Pl. v. fig. 6.

Group IV.

Prosternum broadly convex, striæ at base slightly divergent, then parallel or nearly so, horizontal and abbreviated in front, prosternum in front not narrowed, and on each side with a slight fovea.

The following table will aid in distinguishing the species:

External subhumeral not distinct from the marginal stria.
  Internal subhumeral stria entirely absent..... pectoralis.
External subhumeral stria distinct from the marginal.
  Internal subhumeral distinct and moderately long.
    Prosternum at summit moderately convex, striæ long, internal subhumeral strongly impressed..... obscurus.
    Prosternum carinate, striæ very short, internal subhumeral very fine..... Floridæ.
  Internal subhumeral replaced by a row of coarse, disconnected punctures.....posthumus.
  Internal subhumeral entirely absent.
    Thorax finely and sparsely punctured at sides; elytra finely punctured.....pæminosus.
    Thorax coarsely punctured at the sides, elytra at apex coarsely punctured..... Copei.

The external subhumeral stria in this group is always very short, basal, and joined by its basal end to the marginal stria. In the case of *pectoralis* the presence of that stria is only known by the marginal being slightly deeper at base. In *posthumus* and *Floridæ* the external subhumeral is very close to although distinct from the marginal stria, in all the rest of the species the two striæ are very distinct. Increased collections will undoubtedly decrease the number of the species, two of them may however be known with certainty, *pectoralis* by the prosternal striæ long and convergent in front, and *floridæ* by the prosternum carinate between the striæ.

S. pectoralis, Lec. Ann. Lyc. V., p. 166.

Piceous black, shining; legs and antennæ reddish-brown. Head

sparsely punctulate, without supra-orbital stria. Thorax sparsely and finely punctulate, punctures toward the sides denser and at the margin finer and more sparse, basal margin with very coarse punctures. Elytra with first dorsal stria extending three-fourths, 2–3–4 subequal and extending slightly beyond the middle, striæ punctured and terminating in punctures; fourth dorsal arching and joining the sutural which is very nearly entire, oblique humeral finely impressed, external subhumeral confounded with the marginal, internal entirely absent, surface moderately coarsely punctured at the apical third punctures extending slightly in front of the tips of the striæ and along the suture slightly in front of middle and becoming gradually more sparse. Pygidium and propygidium coarsely but not densely punctured, and on the former gradually finer and less dense toward the apex. Anterior tibiæ finely serrulate, middle and hind tibiæ spinulose. Prosternum moderately elevated, striæ slightly convergent toward the tip, but not attaining the tip nor united. Length .14-.16 inch; 3.5-4 mm.

This species resembles *S. Behrensii* of Group II., in all its superficial characters, but the latter has the prosternal striæ united near the middle of the prosternum. From the characters given in the synoptic table it will be seen that all the species of this group are very closely allied.

The specimens before me are the types collected at San Diego, California.

S. obscurus, Lec. Ann. Lyc. V., p. 166.

Thorax sparsely punctured, punctures gradually coarser and more dense to the extreme margin, along the basal margin still coarser and in front of scutellum a slight impression. Elytra with first stria extending three-fourths the length of the elytra, second and third equal extending two-thirds, fourth shorter and arching at base and joining the sutural which extends nearly to the tip; oblique humeral finely impressed, internal subhumeral long, not joining the humeral, external subhumeral short, visible under the humeral protuberance and joining the marginal at its basal end; surface sparsely, but not coarsely punctured at apical third, punctures gradually becoming finer and rapidly more distant and scatter over the entire surface. Propygidium and pygidium rather finely and moderately densely punctured, punctures evenly disposed over the entire surface. Anterior tibiæ finely serrulate, middle and hind tibiæ spinulose. Prosternum moderately convex, sparsely punctulate, striæ exactly parallel, horizontal, and extending three-fourths to apex. Length .16 inch; 4 mm.

The disc of the thorax is much more distinctly punctured than any species of this group.

Occurs at San Diego, California.

S. Floridæ, n. sp.

Broadly oval, piceous black, shining, legs and antennæ reddish-brown, club darker. Head sparsely punctured. Thorax nearly smooth at middle, sparsely punctured toward the sides and apex, base with coarse punc-

tures and a faint impression opposite the scutellum. Elytral striæ faintly punctured, first dorsal extending three-fourths to apex, second nearly as long, third and fourth attaining the middle only, the latter arching at base, joining the sutural which is entire ; external subhumeral very close to the marginal, humeral oblique, internal subhumeral finely impressed attaining the tip of the first dorsal, but not joining the humeral at base ; surface very sparsely punctured, punctures extending from the apex two-thirds to base and as closely placed anteriorly as at the apex. Propygidium and pygidium closely, but not densely punctured. Anterior tibiæ finely multidenticulate, middle and hind, tibiæ finely spinulose. Prosternum strongly elevated, striæ short scarcely attaining the middle, parallel. Length .10 inch ; 2.5 mm.

This species is the only one of the group in which the prosternum is acutely elevated.

One specimen in my cabinet from Florida.

S. posthumus, Mars. Mon., 55, p. 460, pl. 18, fig. 82.

Head densely punctulate, supra-orbital stria absent. Thorax sparsely punctured at middle, sides more densely and coarsely, at base with coarser punctures, and in front of scutellum a slight impression. Elytra with first dorsal extending three-fourths to apex, 2–3–4 sub-equal, the latter arching at base, joining the sutural which extends nearly to apex ; striæ punctured ; external subhumeral very short, humeral finely impressed, external subhumeral formed of disconnected very coarse punctures ; surface at apex very coarsely but sparsely punctured, punctures extending from the first striæ to the suture, and anteriorly to the tips of the other striæ, and thence anteriorly becoming rapidly finer and more sparse. Pygidium rather densely and coarsely punctured, propygidium more finely and sparsely punctured. Prosternum very feebly convex, striæ deeply impressed, horizontal and very slightly convergent, extending four-fifths to apex. Anterior tibiæ finely denticulate, middle and hind tibiæ spinulose. Length .14.-16 inch ; 3.5-4 mm.

The external subhumeral is so short as to be with some difficulty observed. The unusually coarse elytral punctures and the disconnected internal subhumeral will at once distinguish it from any species of the group.

One specimen from Marseul in Cab. Leconte, and one in my own without special designation of locality. I have received a specimen from Mr. F. Blanchard, collected by him in Massachusetts.

S. pæminosus, Lec. Ann. Lyc. V., p. 166.

Head sparsely punctulate. Thorax very sparsely punctulate on the disc, at sides more coarsely but still sparsely, at base more coarsely and opposite the scutellum a slight impression. Elytra with first dorsal extending three-fourths, second and third equal, extending slightly beyond the middle, fourth slightly shorter and arching at base, joining the sutural which is entire ; external subhumeral short but very distinct, in-

ternal entirely absent, humeral very finely impressed; surface at apex very sparsely and rather finely punctate, becoming rapidly sparser and finer to apex. Anterior tibiæ finely serrulate, middle and hind tibiæ spinulose. Prosternum broad, moderately convex, striæ parallel, horizontal and attaining the apical four-fifths. Length .12–.14 inch; 3–3.5 mm.

Occurs at San Diego, California.

S. Copei, n. sp.

Broadly oval black, shining, legs and antennæ reddish-brown, club darker. Head moderately, neither densely nor coarsely punctured. Thorax sparsely and finely punctured at middle, more densely and very coarsely punctured toward the sides and at margin more sparsely; along the base with coarse punctures, and in front of scutellum a slight depression. Striæ of elytra coarsely punctured, first dorsal extending to apical four-fifths, second and third equal and nearly as long, fourth extending slightly beyond the middle, arching at base, and joining the sutural which is as long as the first dorsal; oblique humeral very fine, internal subhumeral entirely wanting, external subhumeral one-fifth the length of the elytra, distinctly impressed, and joining the marginal in front; surface at apical third coarsely but not densely punctured, punctures becoming rapidly finer near the base, and also near the first stria. Propygidium and pygidium coarsely and rather densely punctured, the latter much more finely at apex. Prosternum moderately convex, sparsely punctured, striæ strongly impressed, very feebly divergent in front, and very slightly ascending. Anterior tibiæ finely multidenticulate, middle and hind tibiæ finely spinulose. Length .14 inch; 3.5 mm.

By the slightly divergent and slightly ascendant prosternal striæ, this species tends toward the next group. The striæ extend four-fifths to apex. The prosternum in front has on each side a slight fovea. Among the species of the group it most closely resembles *posthumus*, from which it differs by its more coarsely punctured thorax, more finely punctured elytra, and differences in the elytral and prosternal striæ as noted above.

Dedicated to Prof. E. D. Cope, by whom it was collected in the region of Fort Bridger, Wyoming Territory.

Group V.

Prosternum broad at summit moderately convex, striæ divergent in front and ascending, but not terminating in a fovea in front. Head with distinct supra-orbital stria extending slightly along the front.

Inflexed portion of elytra bistriate; fourth dorsal not arched at base, punctured space of elytra opaque.... alienus.

Inflexed portion of elytra bistriate; fourth dorsal arched at base, and usually joining the sutural, punctured region not opaque.

Fourth dorsal feebly arched at base, not joining the sutural, the latter short, rarely extending beyond the punctured region; interstrial region coarsely and densely punctured..... lugens.

Fourth dorsal strongly arched at base, usually joining the sutural, interstrial region very slightly or not punctured.

Sutural stria wanting at basal and apical portions, visible for a very slight extent at middle only..... imperfectus.

Sutural stria distinctly impressed at apical portion, and joining the apical marginal stria.

Surface metallic; interstrial spaces not punctured; prosternum strongly convex..... pensylvanicus.

Surface piceous or slightly bronzed; interstrial space more or less punctured; prosternum feebly convex.

Elytral punctures aciculate or very dense..... oregonensis.

Elytral punctures sparse and distinct.

Internal subhumeral and humeral continuous... impressus.

Internal subhumeral not continuous with humeral..... infaustus.

S. alienus, Lec. Ann. Lyc. V., p. 167.

Broadly oval, robust, black, with slight bronze tinge, antennæ and anterior legs reddish-brown. Head densely and coarsely punctured, supra-orbital stria distinct, not advancing across the front. Thorax with slight impression near the anterior angles, disc smooth, at sides punctured, punctures dense and coarser nearer the margin, at base with very few punctures, especially at middle. First dorsal stria of elytra extending slightly beyond the middle, second, third and fourth gradually shorter, fourth not arched at base, sutural very fine and entire; external subhumeral short, deeply impressed, not joining the marginal, humeral fine, joining the short internal subhumeral; inflexed portion of elytra with the marginal and two epipleural striæ; surface with the space between the striæ opaque, not densely punctured, the punctures and opacity following nearly the curve of the inner dorsal stria to the apex of the suture. Propygidium and pygidium moderately punctured, the latter more sparsely at apex. Anterior tibiæ finely 6-denticulate, middle and hind tibiæ finely biseriately spinulose. Prosternum smooth, feebly convex, striæ scarcely ascendant, gradually divergent in front. Length .14-.16 inch; 3.5–4 mm.

This species is one of the most readily known of the group. It had been placed in Group I., with which it has indeed considerable resemblance, and has been separated solely on account of the form of the hind tibiæ of the unique species of that Group.

Occurs at San Diego, and in Owen's Valley, California.

S. lugens, Er. Jahrb., 1834, p. 181; Lec. Bost. Journ. V., p. 21, pl. 5, fig. 4; Mars. Mon., 1855, p. 395, pl. 16, fig. 34; *californicus*, Mann. Bull, Mosc., 1843, ii, p. 259; *consimilis*, Walker, Nat. in Vancouver, 1866. p. 319.

Black moderately shining. Head rather densely punctured in front. Occiput smoother, frontal stria entire, but feeble at middle. Thorax with very feeble impression near the front angles, disc smooth, at sides with punctured space broader in front and base, continuing to the margin except near the hind angles, and narrowly along the basal margin. Elytra with moderately well defined, smooth scutellar space, and a subhumeral space also smoother, remainder of surface densely punctured, punctures becoming aciculate toward the apex; external subhumeral stria distinct, oblique humeral long, extending beyond its junction with the internal subhumeral, which is longer than the first dorsal; first and second dorsals subequal extending two-thirds the length of the elytra, third and fourth equal and slightly shorter than the preceding two, fourth dorsal rarely arched at base, and then the arch formed of punctures, sutural stria short, scarcely extending beyond the punctured space. Propygidium and pygidium rather densely and coarsely punctured. Prosternum in front moderately convex, striæ anteriorly divergent and slightly ascending. Anterior tibiæ finely denticulate, middle and hind tibiæ biseriately spinulose. Length .16–.24 inch; 4–6 mm.

Some of the smaller specimens of this species resemble *distinguendus* very closely.

A very abundant species occurring along the entire plains at the eastern base of the Rocky Mountains, and westward along almost the entire Pacific region.

S. imperfectus, Lec. Bost. Journ. V., p. 70, pl. 5, fig. 3.

Black shining. Head sparsely punctured, frontal stria entire. Thorax smooth at middle, and near the sides with a coarsely punctured space distant from the margin and with the punctures more sparse posteriorly, basal region with a few coarse punctures. Elytra at apex sparsely punctured, punctures extending in the first interstria, which is also slightly wrinkled near the base; external subhumeral distinct; oblique humeral long, bifid at tip, the outer branch joining the internal subhumeral which is slightly longer than the first dorsal; dorsals 1–2–4 subequal, extending slightly beyond the middle, third dorsal much shorter than the others, fourth dorsal slightly arched at base, sutural very short, represented by a few closely approximated punctures near the middle of the elytra. Propygidium and pygidium moderately densely and coarsely punctured, the latter slightly reflexed at the sides. Prosternum moderately convex, striæ in front divergent and slightly ascending. Anterior tibiæ finely denticulate, middle and hind tibiæ biseriately and rather coarsely spinulose. Length .18 inch; 4.5 mm.

This species, from the figure and description, appears to be closely allied to *concinnus*, Mann., from Siberia, but it has a longer third stria.

The type and only specimen known to me, was procured by Maj. Leconte from Melsheimer, by whom it was said to be from Pennsylvania, but as other insects have been obtained from the Melsheimer cabinet with erroneous localities, this might be looked upon with some suspicion.

S. pensylvanicus, Payk. Mon., p. 62, pl. 5, fig. 6; Lec. Bost. Journ. V., p. 71, pl. 5, fig. 5; Mars. Mon., 1855, p. 435, pl. 17, fig. 63.

Form broadly oval, robust, color variable from brilliant metallic-green to bronze. Head very sparsely and finely punctulate, frontal stria broadly interrupted. Thorax smooth with a few moderately coarse sparsely placed punctures along the sides distant from the margin, finer near the base, and a narrow basal series of rather coarse punctures; margin sparsely fimbriate. Elytra coarsely but sparsely punctured at the apical half, not extending to the first dorsal stria; external subhumeral distinct, humeral fine, oblique, internal subhumeral longer than the first dorsal, strongly impressed, but not joining the humeral; first dorsal extending two-thirds to apex, second shorter, third very short, but variable, sometimes subobsolete, fourth shorter than the second, broadly arching at base and joining the sutural which is entire. Pygidium and propygidium coarsely and rather densely punctured. Prosternum convex in front, striæ divergent and ascending. Anterior tibiæ coarsely serrate, middle and hind tibiæ biseriately spinulose. Length .16–.20 inch; 4–5 mm.

Occurs everywhere in the United States east of the Rocky Mountains.

S. oregonensis, Lec. Bost. Journ. V., p. 75, pl. 5, fig. 12; Mars. Mon., 1855, p. 397, pl. 16, fig. 36; *var. distinguendus*, Mars. loc. cit. p. 441, pl. 17, fig. 68; *spurcus*. Lec. Col. Kansas, 1859, p. 7; *sejunctus*, Mars. Mon., 1862, p. 449, pl. 12, fig. 10.

Black, shining, submetallic. Head sparsely punctured, stria interrupted at middle. Thorax smooth at middle, toward the sides sparsely and coarsely punctured in a narrow space, punctures finer posteriorly, margin much smoother, a few coarse punctures along the base, obsolete at middle. Sides of elytra very sparsely punctured, dorsal surface rather densely punctured at apical half, punctures variable in their extent between the striæ; external subhumeral short distinct, oblique humeral finer and joining the internal subhumeral, which is longer than the first dorsal; dorsal striæ subequal, extending slightly beyond the middle, fourth arching at base and joining the sutural, which is usually entire, sometimes interrupted near the base. Pygidium and propygidium coarsely and rather densely punctured. Prosternum broad, striæ divergent in front and scarcely ascending. Anterior tibiæ finely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .12–.18 inch; 3–4.5 mm.

Var. oregonensis, Lec. (*spurcus*, Lec.), fourth dorsal stria arching at base and joining the sutural, which is entire and strongly impressed. Punctures of elytra extending to the base in the entire first interstria, and in the outer portion of the second. Oregon, Utah.

Var. distinguendus, Mars. Sutural stria as in the preceding. Punctures of the elytra extending along the first and second interstrial spaces to base. Canada, Wisconsin.

Var. sejunctus, Mars. (*oregonensis*, ‡ Mars.) Sutural stria interrupted near the base. Elytral punctures not extending forward between the striæ. New Mexico, Utah, Wyoming.

The series before me being very much larger than those seen by Marseul, I find myself compelled to unite all the above under one name. The latter variety may seem distinct by the characters given, but the extent of punctuation varies in all the forms to such a degree as to be of no value whatever in the separation of species. The interruption of the union between the fourth dorsal and sutural striæ, has caused Marseul to place *distinguendus* and *sejunctus* in separate groups. I have specimens which are true *sejunctus* in punctuation with the arc entire, and others even with the sutural interrupted on one side and entire on the other, in fact every conceivable variation between *distinguendus*, the most densely punctured form, and *sejunctus* on the other extreme.

This is an abundant species, occurring from Arizona to Oregon, and along the eastern base of the Rocky Mountains, and eastwardly to Canada.

S. impressus, Lec. Bost. Journ. V., p. 74, pl. 5, fig. 10.

Black, shining, legs piceous. Head very sparsely punctulate, frontal stria interrupted at middle. Thorax at anterior angles slightly impressed, disc smooth, sides coarsely punctured to the extreme margin, base coarsely punctured and slightly impressed opposite the scutellum. Elytra sparsely punctured at apex, punctures sparsely extending to base along the first interstria, which is also wrinkled near the base; external subhumeral short, humeral oblique, finely impressed, joining the internal subhumeral, which is slightly longer than the first dorsal; the latter extending two-thirds to apex, and equal to the third, second slightly longer, fourth shorter than the third and arching at base, joining the sutural which is entire. Propygidium and pygidium coarsely and rather densely punctured, the latter more sparsely at apex. Prosternum moderately broad, striæ slightly divergent at apex and not ascending. Anterior tibiæ minutely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .14 inch; 3.5 mm.

Two specimens, Georgia.

S. infaustus, Lec. Proc. Acad., 1852, p. 40; *piceus*, ‖ Lec. Bost. Journ. V., p. 73. pl. 5, fig. 8.

Piceous, shining. Head sparsely punctate, frontal stria wanting. Thorax smooth at middle, sparsely punctured at sides and base, and slightly impressed at the anterior angles. Elytra sparsely punctured at apical half, punctures sparsely extending to base of first interstria; external subhumeral scarcely evident, oblique humeral very fine, widely separated from the internal subhumeral, which is strongly impressed and longer than the first dorsal, the latter extending three-fourths to apex,

striæ 2–3–4 subequal, slightly shorter than the first; fourth arching at base, joining the entire sutural. Pygidium and propygidium moderately coarsely, but not densely punctured. Prosternum broad, sparsely punctured, striæ deeply impressed, slightly divergent in front and scarcely ascending. Legs brownish red. Anterior tibiæ finely and distantly denticulate, middle and hind tibiæ finely biseriately spinulose. Length .10 inch; 2.5 mm.

Closely allied to the preceding species, differing in its smaller size, scarcely evident external subhumeral and the disconnected internal subhumeral.

One specimen, Pennsylvania.

I have seen specimens from Oregon and Vancouver, differing from the unique of *infaustus* in having the external subhumeral somewhat more distinct, and by the form more regularly oval. I do not feel inclined to separate them at present, as I find no tangible character on which to found a specific distinction.

Group VI.

Prosternum more or less convex at summit, striæ entire, divergent in front, terminating in a fovea. Supra-orbital stria rarely present. Thorax rarely fimbriate.

The species are more numerous than in the preceding groups, and are distinguished in the following manner:

Pygidium with a deep marginal groove.
  Groove following the entire apical and lateral margins..... æneicollis.
  Groove at apex only..... ..... assimilis.
Pygidium not grooved.
  Thorax not ciliate at the sides.
    Elytra punctured at apex, and thorax at sides, only.
      Elytra densely aciculately punctured, striæ short. cubæcola.
      Elytra sparsely punctured, striæ moderately long.
        Fourth dorsal and sutural united, the latter strongly impressed at base.
          Sutural stria continued by punctures to apex, elytra at apex rather coarsely punctured.
            External subhumeral short, distinct..... conformis.
            External subhumeral stria entirely absent.
              Dorsal striæ hooked at base..... placidus.
              Dorsal striæ simple..... ..... vescus.
          Sutural stria entire, usually joining the apical line.
            Dorsal striæ 1–3 hooked at base; thorax distinctly punctured at sides..... parumpunctatus.

Dorsal striæ not hooked at base; thorax very minutely punctulate.	
Sutural stria not joining an apical line, the latter obliterated at middle.....	convexiusculus.
Sutural stria continued by an entire apical line.....	minutus.
Fourth dorsal arched at base, sutural interrupted at base.	
Sutural stria moderately deeply impressed, abbreviated at base only.	
Color piceous; pygidium smooth at apex.	scissus.
Color, brownish; pygidium sparsely punctured.....	scrupularis.
Sutural stria very feeble, interrupted at base and apex.....	wacoensis.
Elytra more or less punctured over the entire surface; thorax either densely punctured over the entire surface or punctured as strongly at middle as at the sides.	
Fourth dorsal joining the sutural by a strong arc; pygidium moderately convex.	
Sutural stria feeble at base; thorax sparsely punctured.....	laridus.
Sutural stria strongly impressed; thorax rather densely punctured.....	insertus.
Fourth dorsal simply hooked at base; pygidium strongly convex, apical portion inflexed at a right angle to the superior portion.....	æquipunctatus.
Thorax ciliate at the sides; head coarsely punctured; sutural stria interrupted at base.....	ciliatus.

From the construction of the above table it will be inferred that the species are very closely allied, and it is probable that collections made across the continent will unite some of those, not only in this but also in other groups, which are separated on trifling characters, which are really more geographical than entomological. I have united three species under the name *insertus*, to avoid the other alternative of giving nearly every specimen a name.

S. æneicollis, Mars. Mon., 1855, p. 424, pl. 17, fig. 56; Horn, Trans. Am. Ent. Soc., 1870, p. 141.

Form moderately robust, surface metallic, thorax dark, elytra greenish-blue. Head moderately densely punctured, front slightly impressed, without stria. Thorax impressed at the anterior angles, disc smooth, at sides coarsely punctured, punctures more dense in front, margin comparatively smooth. External subhumeral stria short but distinct, humeral oblique moderately impressed, internal subhumeral deeply impressed, apical, not joining the humeral; first dorsal long, extending three-

fourths to apex, second shorter, continued by regular punctures, third short, basal, continued by irregular punctures, fourth as long as second, and similarly continued, broadly arching at base and joining the sutural, which is entire, but rather feebly impressed at its basal portion; between the fourth and sutural an irregular row of punctures extending slightly in front of middle forming a *quasi* fifth stria; surface of elytra at apex moderately coarsely but sparsely punctured; punctures coarser near the suture, and extending more anteriorly. Propygidium and pygidium densely aud coarsely punctured, the latter somewhat aciculate, and with the entire margin surrounded by a deep groove. Body beneath black, legs piceous. Anterior tibiæ multidenticulate, middle and hind tibiæ biseriately spinulose. Prosternum moderately elevated, but not carinate, striæ divergent in front and strongly ascendent, terminating on each side in front in a fovea. Length .18 inch; 4.5 mm.

One specimen from Texas. Resembles *pensylvanicus* at first sight, but may be known from every other Saprinus in our fauna by the entire marginal groove of the pygidium. The entire surface of the elytra has a few punctures over the entire surface, but very distantly placed.

S. assimilis, Payk. Mon. p. 63, pl. 5, fig. 7; Mars. Mon., 1855, p. 431, pl. 17, fig. 60; *extraneus*, Knoch. Illig. Mag. VI., p. 34.

Broadly oval, black, shining. Head sparsely punctulate, supra-orbital stria obsolete. Thorax impressed near the anterior angles, disc smooth, sides coarsely and densely punctured, margin smoother, base with very few punctures and distinctly impressed in front of scutellum. Elytra coarsely punctured at apex, punctures extending in the sutural region to the middle; external subhumeral stria short, deeply impressed, close to the marginal; humeral oblique not joining the internal subhumeral, which is rather deeply impressed and terminating in punctures at apex; first dorsal extending three-fourths to apex, second somewhat shorter, third and fourth equal shorter than the second, and terminating in coarse punctures; fourth stria joining the sutural which is deeply impressed at basal portion, gradually becoming more feeble, and not attaining the apex; apical marginal stria wanting. Propygidium and pygidium coarsely and rather densely punctured, the latter with a deep marginal groove at apex, and a slight impression at tip. Anterior tibiæ finely multidenticulate, middle and hind tibiæ biseriately spinulose, the posterior the more finely. Prosternum smooth, broadly convex, striæ strongly ascending, terminating on each side in a fovea. Length .16–.20 inch; 4–5 mm.

Occurs from the Middle States to Texas.

S. cubæcola, Mars. Mon., 1855. p. 167, pl. 18, fig. 88; Horn, Trans. Am. Ent. Soc., 1870, p. 140.

Black, shining. Head sparsely punctured, occiput slightly impressed, supra-orbital stria subobsolete. Thorax smooth, at anterior angles broadly impressed, at sides punctured, coarsely in front, more finely and sparsely toward the base and the extreme margin, basal margin with a

line of coarse punctures. Elytra densely aciculately punctured at apical two-thirds, punctures extending to the bases of all the interstriæ except the inner; external subhumeral close to the marginal, short, humeral slightly oblique, internal subhumeral represented by a few punctures; first dorsal extending beyond the middle, striæ 2–3–4 short, subequal, fourth arching at base joining the sutural, which is entire and continuous with the apical marginal. Propygidium coarsely, but sparsely punctured. Pygidium, convex, sides slightly reflexed, surface coarsely and moderately densely punctured. Anterior tibiæ finely denticulate, middle and hind tibiæ biseriately spinulose. Prosternal striæ divergent, strongly ascending, terminating in front in a fovea. Length, .16 inch; 4 mm.

One specimen in my cabinet from Key West, others will probably occur in Florida.

S. conformis, Lec. Bost. Journ. V., p. 72, pl. 5, fig 7; Mars. Mon., 1855, p. 484, pl. 18, fig. 103.

Black, shining. Head sparsely punctulate, supra-orbital stria entirely wanting. Thorax smooth at middle punctured at the sides to the extreme margin, punctured space narrowest at middle. Elytra coarsely but not densely punctured at apex, punctures forming an irregular triangular space, extending at suture slightly in front of middle; external subhumeral short, close to the marginal, humeral very fine, internal subhumeral short, subapical and moderately deeply impressed; first dorsal extending four-fifths to apex, 2–3–4, gradually shorter, the fourth arched, joining the sutural which extends two-thirds to apex and thence continued by punctures; apical marginal line obliterated near the suture, Pygidium and propygidium densely and coarsely punctured. Anterior tibiæ finely denticulate, middle biseriately spinulose, hinder spinulose at apex only. Prosternum strongly convex, striæ divergent in front, ascending, terminating in a fovea, anteriorly. Length .10–.12 inch; 2.5–3 mm.

Occurs from Pennsylvania to Georgia.

S. placidus, Er. Jahrb., 1834, p. 189; Mars. Mon., 1857, p. 444, pl. 11. No. 33, fig. 103 bis; *latubris,* Lec. Proc. Acad. 1859, p. 315.

Black, shining. Head finely punctulate, supra-orbital stria subobsolete. Thorax smooth at middle, sparsely punctured at the sides. Elytra sparsely but rather coarsely punctured at the apical third; external subhumeral stria absent, humeral fine, internal subhumeral, short apical, separated from the humeral; first dorsal deeply impressed in its entire length, extending beyond the middle, second somewhat longer, gradually less deeply impressed to tip, third and fourth sub-equal, the latter arching at base, joining the sutural which does not attain the tip of the elytra; apical marginal line obsolete at middle. Propygidium sparsely punctured, pygidium sparsely punctured at base, gradually becoming shorter at apex. Prosternum rather acutely convex, striæ divergent and ascending. Legs piceo-rufous, anterior tibiæ finely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .08–.10 inch; 2–2.5 mm.

Occurs in Georgia and Missouri. Closely allied to *conformis*, but differs by the absence of the external subhumeral, and the thorax much more finely punctulate at the sides. It is compared by Marseul to *neglectus*, with what it appears to have very little in common. *S. latubris*, Lec., is a variety with the internal subhumeral reduced to a point.

S. vescus, Mars. Mon., 1855, p. 488, pl. 17, fig. 106.

Oblong oval, black, shining, moderately convex. Head sparsely and finely punctured. Thorax sparsely punctured at the sides, and with a row of coarse punctures along the base. Elytra sparsely and moderately coarsely punctured at the apical half, punctures extending between the striæ; external subhumeral stria entirely absent, oblique humeral moderately impressed; internal subhumeral short apical; dorsal striæ deeply impressed and punctured, first dorsal extending four-fifths to apex, and at tip approaching the second dorsal, second and third nearly equal, slightly shorter than the first, fourth somewhat shorter than the third, arching, at base joining the sutural which extends three-fourths to apex. Propygidium moderately densely punctured, pygidium more sparsely and finely punctured, gradually smoother to apex. Anterior tibiæ finely denticulate, middle and hind tibiæ finely spinulose. Length .12 inch, 3 mm.

This species is very closely allied to *placidus*, Er., but differs in its less convex form and more broadly convex prosternum. The elytral punctures are finer and more densely placed, but extend more anteriorly and also between the striæ. The striæ are also longer and not hooked at base as is always is the case in *placidus*. Marseul's figure of *vescus* is not characteristic.

Through the great liberality of M. Marseul, I have been enabled to study this unique type from his cabinet.

Occurs in Texas.

S. parumpunctatus, Lec. Col. Kansas, 1859, p. 7.

Broadly oval, castaneous, shining. Head sparsely punctured, supraorbital stria obsolete. Disc of thorax smooth, towards the sides sparsely but not densely punctulate, punctures extending along the base in a moderately wide space. Elytra sparsely punctured at apex, punctures very sparsely extending to base along the suture; external subhumeral very close to the marginal and scarcely distinct; oblique humeral moderately impressed; not joining the internal subhumeral which is feebly impressed; first dorsal extending four-fifths to apex, second and third sub-equal, very slightly shorter, fourth extending to middle, arching at base, joining the sutural which is entire; apical marginal line obliterated near the suture. Propygidium sparsely punctured, pygidium more densely and coarsely punctured except near the apex. Prosternal striæ divergent scarcely ascending. Metasternum very coarsely punctured. Anterior tibiæ finely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .12 inch; 3 mm.

The dorsal striæ 1–3 are all hooked at base, or rather have a short process extending parallel with the base.

One specimen, Kansas. The pale color may, in part, be due to immaturity.

S. convexiusculus, Mars. Mon., 1855, p. 404, pl. 19. fig. 111.

Black, shining, surface with faint bronze tinge. Head punctulate, supra-orbital stria obsolete, frontal stria visible at the sides. Thorax smooth at middle, with a broad space at sides and very minutely punctulate, and at base more coarsely punctured. Elytra very sparsely punctured at apical third, punctures extending within the striæ and along the suture in front of middle ; external subhumeral entirely absent, humeral fine, oblique, not joining the short internal subhumeral ; first dorsal extending four-fifths to apex, 2–3–4, gradually and but slightly shorter, the latter arching at base joining the sutural, which is entire, apical marginal line obsolete. Propygidium and pygidium moderately densely punctured. Prosternal striæ divergent, feebly ascending. Legs brownish-red, anterior tibiæ fine denticulate, middle and posterior finely biseriately spinulose. Length .10 inch ; 2.5 mm.

One specimen from North Carolina, from the collection of the late Dr. Zimmermann.

S. minutus, Lec. Bost. Journ. V., p. 73, pl. 5, fig. 9; Mars. Mon., 1855, p. 486, pl. 18, fig. 104.

Black, with slight tinge of bronze, shining. Head, sparsely punctulate, supra-orbital striæ wanting, frontal stria obsolete at the sides. Thorax smooth at middle, very finely and sparsely punctulate towards the sides. Elytra very sparsely punctulate at the apical third, punctures extending forward along the suture, in front of the middle; external subhumeral stria wanting, oblique humeral moderately impressed, usually continuous with the external subhumeral which extends three-fourths to apex ; first and second dorsals equal extending three-fourths ; third extending slightly beyond middle, and fourth to middle only, joining the sutural which attains the apex, and continued by the apical line to the marginal. Propygidium and pygidium sparsely punctured. Legs rufous. Anterior tibiæ finely denticulate, middle and hind tibiæ finely biseriately spinulose. Prosternal striæ divergent and strongly ascending. Length .08 inch; 2 mm.

This species is very closely allied to the preceding, and differs principally in the longer internal subhumeral. The elytral punctures of this species are coarser and much less closely placed than in *convexiusculus*. In the "Catalogus (Gemm. and Harold) p. 789, this species is placed as synonymous with *plenus*," which it does not even remotely resemble.

Occurs in the Middle States.

S. scissus, Lec. Ann. Lyc. V., p. 168.

Piceous, shining. Vertex very minutely punctulate, clypeus rugose, supra-orbital stria obsolete, frontal visible at the sides. Thorax with a

few distant fine punctures on the disc, at sides very sparsely punctulate. Elytra sparsely punctured at apex, punctures at middle extending two-thirds to base. External subhumeral very short, humeral oblique, finely impressed, not joining the internal subhumeral which is short and deeply impressed, dorsals 1–2–3 equal, extending slightly beyond the middle, fourth shorter, arching at base, sutural deeply impressed, basal third obliterated, joining at apex the marginal line. Propygidium and pygidium sparsely and rather finely punctured. Prosternal striæ divergent and nearly horizontal. Legs brownish-red, anterior tibiæ finely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .06–.08 inch; 1.5–2 mm.

One of the smallest species of Saprinus and readily known by the characters in the table. From *scrupularis* it moreover differs by the entirely smooth disc of thorax, which in that species is moderately coarsely but sparsely punctured.

Occurs in California.

S. scrupularis, Lec. Proc. Acad., 1859, p. 315.

Piceous, shining. Legs brownish-red. Head sparsely punctured, frontal stria slightly visible at the sides. Thorax very sparsely punctulate at the disc, more coarsely and densely at the sides. Elytra at apex sparsely punctured, punctures fine at apex and extending in the interstriæ and sutural space nearly to base; external subhumeral short but distinct, humeral finely impressed, internal subhumeral finely impressed, disconnected; first dorsal extending to middle, second and third somewhat longer, fourth slightly shorter than first, arched at base; sutural finely impressed, basal third obliterated, attaining the apical margin, apical line obsolete. Propygidium and pygidium sparsely and rather finely punctured. Anterior tibiæ finely denticulate, middle and hind tibiæ, finely biseriately spinulose. Length .06 inch; 1.5 mm.

Resembles *laridus*, which, however, has the sutural abbreviated at apex, and the thorax nearly as closely punctured at middle as at the sides.

Occurs in the Southern States.

S. wacoensis, n. sp.

Broadly oval, black shining. Front sparsely, clypeus more densely punctured; supra-orbital stria obsolete, frontal visible at the sides. Thorax smooth at the middle, moderate densely punctured towards the sides, margin smoother. Elytra sparsely punctured at apex; punctures forming a triangular space, the apex at the basal fourth of the suture; external subhumeral wanting, humeral fine, oblique, internal subhumeral obsolete; first dorsal extending four-fifths to apex, second and third nearly equal, slightly shorter than first, fourth extending to middle only, arched at base; sutural short, feebly impressed, apical fifth and basal third entirely obliterated. Propygidium and pygidium coarsely but not densely punctured. Prosternal striæ divergent, feebly ascending, prosternum broadly convex. Legs brownish red, anterior tibiæ finely serru-

late, middle and hind tibiæ finely biseriately spinulose. Length .10 inch; 2.5 mm.

This species in its general aspect resembles *convexiusculus*. It is the only species in the group with both subhumeral striæ obliterated, and with the sutural also obsolete at base and apex.

One specimen (No. 546) collected by Mr. G. W. Belfrage, at Waco, Texas.

With the next species begins a small group in which the thorax is punctured over its entire surface, always equal (or very nearly so) at the disc and sides. The elytra are also punctured from apex to base, and like the thorax, nearly equally over the entire surface.

S. laridus, Lec. Ann. Lyc. V, p. 168.

Piceous, shining, legs brownish-red. Head rather coarsely punctured, supra-orbital and frontal striæ obliterated. Thorax coarsely, but sparsely punctured, slightly more densely at the sides, in front of scutellum slightly impressed. Elytra sparsely punctured over the entire surface, somewhat less densely at base; external subhumeral short, but distinct, humeral oblique, rather deeply impressed, separated from the internal subhumeral by a very slight space, the latter stria deeply impressed at the basal portion, extending three-fourths to apex; dorsals 1–4 sub-equal, extending slightly beyond the middle, the fourth arcuate at base joining the sutural, which is rather less impressed at basal third and apt to become obsolete and obliterated at apical fourth. Propygidium and pygidium moderately coarsely, but not densely punctured, the latter much smoother at apex. Prosternal striæ strongly divergent and slightly ascending. Anterior tibiæ minutely denticulate, middle and hind tibiæ finely biseriately spinulose. Length .06–.08 inch; 1.5–2 mm.

It is in this species that the smallest representatives of the genus Saprinus occur in our fauna. In its aspect it recalls *scissus* but differs in its punctuation and other characters as given above.

Occurs in California.

S. insertus, Lec. Ann. Lyc. V., p. 167; *obductus*, Lec., *vinctus*, Lec. *l. c.* p. 168.

Black, shining, surface with faint bronze tinge. Head moderately, densely and coarsely punctured; supra-orbital stria obliterated, frontal slightly visible at the sides. Thorax rather coarsely but not densely, and nearly equally punctured over the entire surface, punctures at sides slightly aciculate. Elytra punctured similarly to the thorax; external subhumeral confluent with the marginal; oblique humeral moderately impressed, nearly continuous with the internal subhumeral, which extends three-fourths to apex; first dorsal extending three-fourths, second slightly beyond the middle, third and fourth slightly shorter, the latter arching at base, joining the sutural, which is entire. Propygidium and pygidium densely and rather coarsely punctured. Prosternum broadly convex, punctured, striæ divergent and slightly ascending. Anterior tibiæ

finely multidenticulate, middle and hind tibiæ finely biseriately spinulose. Length .10–.14 inch ; 2.5–3.5 mm.

After repeated examination I am unable to find any characters on which to separate the three species in the above synonymy.

Occurs in California and Oregon.

I have in my cabinet a specimen from the Yo Semite Valley, California, which is closely allied to the preceding, differing in its less convex form, striæ longer, elytra very densely aciculately punctured at apex, and with a narrow basal space somewhat broader at the suture nearly free of punctures. At present I do not feel warranted in giving it a name as I have never seen other than the one specimen.

S. æquipunctatus, Horn, Trans. Am. Ent. Soc., 1870, p. 140.

Oblong oval, black, feebly shining. Head moderately densely punctured, supra-orbital obsolete, frontal slightly visible at the sides. Thorax nearly equally, coarsely and rather densely punctured over the entire surface. Elytra densely punctured over the entire surface ; external subhumeral wanting, humeral fine oblique, joining the internal subhumeral which extends four-fifths to apex ; dorsal striæ straight, parallel, first extending four-fifths to apex, 2–3–4 gradually and very slightly shorter, the fourth not arcuate at base ; sutural stria feeble especially at base where it forms a slight arc within the fourth dorsal. Propygidium densely and coarsely punctured, pygidium apparently double, upper portion vertical, apical part horizontal, surface densely and coarsely punctured. Prosternum broadly convex, punctured, striæ divergent and very feebly ascending. Anterior tibiæ finely multidenticulate, middle and hind tibiæ finely biseriately spinulose. Length .12–.14 inch ; 3–3.5 mm.

This species is one of the most distinct and easily recognizable in our fauna. Pl. v. fig. 8.

Occurs near San Francisco, California.

S. ciliatus, Lec. Ann. Lyc. V., p. 168.

Broadly oval, brownish, surface with slight bronze tinge. Head densely rugoso-punctate, supra-orbital moderately distinct and frontal stria slightly visible at the sides. Thorax with the entire margin ciliate with moderately long hairs, disc sparsely punctured, sides densely and aciculately punctured to the extreme margin. Disc of elytra sparsely and finely punctured, sides and apex densely aciculately punctured ; external subhumeral short basal, humeral fine, oblique, uniting by punctures with the internal subhumeral, which extends two-thirds to apex, first dorsal extending slightly beyond the middle, third extending nearly to apex of elytra, second intermediate between the first and third, fourth extending to apical three-fourths and arched at base ; sutural finely impressed, entirely obsolete at basal fourth ; apical marginal line obsolete. Propygidium and pygidium moderately densely but not coarsely punctured. Prosternum broadly convex, striæ divergent and slightly ascending. Legs rufous, anterior tibiæ rather coarsely denticu-

late, middle and posterior tibiæ biseriately spinulose. Length .10 inch ; 2.5 mm.

The rather coarsely denticulate tibiæ and fimbriate margin ally this species to some of the following groups. The middle tibiæ are also more coarsely spinulose than is usual in this or any of the preceding groups.

This species appears to be rare in California.

Group VII.

Prosternum narrow, acute at summit, striæ almost entirely lateral, strongly divergent anteriorly, ascending, terminating in a shallow depression. Thorax with margins fimbriate in nearly all the species.

This group and the preceding are very closely allied, and it becomes a matter of difficulty with some of the species of both groups to decide to which they should be referred. It is probable that a more natural division would be into those which have, and those which have not the margins of the thorax fimbriate. In the event of such a division of the groups, *neglectus* and *rubriculus* should enter the preceding, and *ciliatus* removed from it.

With the exception of two unique types before me, all the species are represented by good series of specimens, and an amount of variation is seen leading to the belief that were similar series collected of all the species, the number of our Saprini would be reduced fully one-half.

A study of the material before me has resulted in the following table, which I believe exhibits the forms which are entitled to rank as species :

Prothorax with margins not fimbriate.

Prosternal striæ well-marked, fossæ simple..... neglectus.
Prosternal striæ feeble, fossæ linear uniting at the summit of the prosternal carina in front..... rubriculus.

Prothorax with fimbriate margins.

Elytra with smooth scutellar space, sometimes well-limited.
Third dorsal stria entirely obliterated..... vitiosus.
Third dorsal normally developed.
Scutellar mirror distinctly limited behind.
Interstrial spaces densely punctured..... lubricus.
Smooth space at the base between striæ 2–4..... plenus.
Scutellar mirror not well defined, punctures diffuse.
Third dorsal attaining the base of elytra..... fimbriatus.
Third dorsal abbreviated at base..... acilinea.

Elytra punctured over the entire surface which is opaque.
Color, bluish ; elytra less densely punctured in the subscutellar region.....cœrulescens.
Color, brownish ; elytra equally densely punctured..... vestitus.

S. neglectus, Mars. Mon., 1855, p. 491, pl. 18, fig. 108.

Oval, convex, surface distinctly bronzed. Head moderately punctured. Thorax moderately coarsely punctured at the sides, more finely along the apex, and with a few coarse punctures along the basal margin. Elytra rather coarsely, but sparsely punctured, punctures extending slightly in front of middle and outside of the first stria to the base; external subhumeral stria not distinct from the marginal, internal moderately long joining the humeral; first dorsal extending slightly beyond the middle, second extending two-thirds, third and fourth equal to the first, fourth arching at base with the sutural which is entire. Propygidium densely punctured, pygidium more sparsely punctured. Anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .12 inch; 3 mm.

This species is closely allied to those of the preceding group, with which it had been associated. The prosternum is, however, acutely carinate. In this species may be seen the rather curious tendency of the striæ to be prolonged by smooth lines between the punctures. This character is, however, much better shown in *fimbriatus*.

This species occurs in Georgia.

S. rubriculus, Mars. Mon., 1855, p. 489, pl. 18, fig. 107.

Oblong oval, moderately convex, ferruginous brown, shining. Head finely and densely punctured. Thorax sparsely punctured over the entire surface, slightly more densely at the sides. Elytra sparsely punctured, punctures coarser in front, and denser at apex, extending slightly in front of middle, and also between the striæ; external subhumeral absent, internal short apical; first dorsal extending two-thirds the length of the elytra, 2–3–4 gradually shorter, the latter arching at base, sutural attaining the apex interrupted at base, continued by fine punctures to the arch of the fourth dorsal. Pygidium moderately convex densely and moderately coarsely punctured. Anterior tibiæ 5–6 denticulate, middle and hind tibiæ spinulose. Prosternum carinate, striæ very indistinct. Prosternal fossæ linear uniting at the summit of the carina in front. Length .09 inch; 2.25 mm.

The type of this species is before me, and although not properly authenticated as far as habitat is concerned, is introduced into the present essay from its decidedly American aspect. From all the species of Saprinus in our fauna it may be distinguished by the curious form of the prosternal fossæ in which the striæ terminate. In place of being merely rounded pits as is usual when they occur, these fossæ are linear and extend to the summit of the prosternal carina parallel with the anterior margin of the lobe, which is also more prolonged than is usual in the genus. The interrupted sutural stria is also peculiar to this species in the present group.

One specimen, locality doubtful.

S. vitiosus, Lec. Ann. Lye. V., p. 169.

Oval, convex, brownish, surface distinctly bronzed. Head moderately

densely punctured, frontal stria slightly interrupted at middle. Thorax with fimbriate margin, surface minutely and very sparsely punctured on the disc, much more densely and coarsely at the sides, and with a row of coarse punctures along the base. Elytra densely punctured at apex, punctured space neatly limited in front, and extending equally densely along the interstrial spaces to base, except a space near the base between the striæ 2–4; external subhumeral confluent with the marginal, internal moderately long, joining the humeral; first dorsal confused at base extending beyond the middle, second distinct equal to the first, third entirely obliterated, rarely a rudiment at base or a few punctures, fourth dorsal extending to middle, arching at base, joining the sutural which is entire. Propygidium and pygidium coarsely and moderately densely punctured. Anterior tibiæ finely 6–7 denticulate, middle and third tibiæ spinulose. Length .10–.14 inch; 2.5–3.5 mm.

The juxta-scutellar impunctured space varies in extent. All the specimens agree in the entire obliteration of the third dorsal. This species and *rugipennis* have a remarkable superficial resemblance, but differ in the structure of the prosternum.

Occurs from Owen's Valley, California, southward to Cape San Lucas, also in Arizona.

S. lubricus, Lec. Ann. Lyc. V., p. 169; Mars. Mon., 1855, p. 410, pl. 17, fig. 46; *rotundifrons*, Mars. Mon., 1862, p. 464, pl. 12, fig. 24.

Oval, moderately convex, black, shining, surface slightly bronzed. Head coarsely and moderately densely punctured, frontal stria interrupted at middle. Thorax with lateral margins fimbriate, at sides with moderately broad and well defined space coarsely and densely punctured; punctures slightly stronger at the margins, a narrow basal space punctured. Elytra with well defined smooth space, punctures coarse and dense at apical third, extending also to the bases of the interstrial spaces and equally dense; external subhumeral absent, internal feebly impressed continuous with the humeral; first dorsal confused at base extending nearly to middle, second somewhat longer, third equal to the first, fourth equal to the second, arched at base joining the sutural which is entire and deeply impressed, sutural interspace with a row of punctures. Propygidium and pygidium densely, but not very coarsely punctured. Anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .10–.14 inch; 2.5–3.5 mm.

This is the only species of the present group in which the scutellar space is entirely surrounded by a dense punctuation. The type of *rotundifrons*, Mars., is before me, and is an exact reproduction of the type of *lubricus*.

Occurs in California, especially in the southern portion of the State.

S. plenus, Lec. Ann. Lyc. V., p. 169; *olidus*, Lec. Proc. Acad., 1859, p. 316; *pratensis*, Lec. Col. Kansas, 1859, p. 8.

Oval, convex, shining, surface distinctly bronzed. Head convex,

moderately coarsely and densely punctured. Thorax with margin ciliate, disc minutely and very sparsely punctulate, sides coarsely and moderately densely punctured; punctures extending slightly along the apex, and very narrowly along the base. Elytra densely punctured at apex, punctured space neatly limited in front, punctures extending to the bases of the first and second interstriæ; external subhumeral very short, internal short, feebly impressed and disconnected; first dorsal extending slightly beyond the middle, 2–3–4 gradually shorter, the latter arched at base joining the sutural which is entire. Pygidium moderately densely and coarsely punctured. Anterior tibiæ finely multidenticulate, middle and hind tibiæ spinulose. Length .10–.14 inch; 2.5–3.5 mm.

The smooth space at the base of the two inner interstriæ varies in extent. The species is somewhat variable. The above description is drawn from the type, *pratensis* is a smaller form less distinctly bronzed, *olidus* is more broadly oval.

By some unaccountable error, Gemminger and Harold quote *minutus* as synonymous with *plenus*. In the "List" of the Coleoptera of N. A., *desertorum*, Mars., is similarly placed, but erroneously. This species is the *aciculatus* of the MS. catalogue of Dr. Leconte, and specimens may have been distributed under that name.

This species is widely distributed from California, through Arizona and New Mexico to Texas and Kansas.

S. fimbriatus, Lec. Ann. Lyc. V., p. 169; Mars. Mon., 1855, p. 495, pl. 19, fig. 112; *desertorum*, Mars. Mon., 1857, p. 442, pl. 11, No. 33, fig. 88. b; var. *orbiculatus*, Mars. Mon., 1855, p. 497, pl. 19, fig. 114.

Oval, convex, piceous, elytra brownish, surface bronzed. Head moderately punctured, frontal stria interrupted at middle. Thorax with margins fimbriate, disc minutely and very sparsely punctulate, sides with broad punctured space, punctures moderately dense and gradually coarser to the margin, a slight impression near the anterior angles, and a narrow space punctured along the basal margin. Elytra punctured at apical half, punctures sparse and moderately coarse, extending along the outer two interstrial spaces to base; external subhumeral always present, variable in length, usually short, internal moderate joining the humeral; first dorsal extending to middle, second longer, third shorter than the first, fourth equal to first, arching at base, joining the sutural which is entire; striæ continued by smooth lines between the striæ, of variable distinctness. Propygidium and pygidium moderately densely and coarsely punctured. Legs rufous, anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .08–.14 inch; 2–3.5 mm.

Var. *fimbriatus*, Lec. Punctures extending in the first two interstriæ to base, sparse but moderately coarse. External subhumeral deeply impressed, short and distant from the margin, striæ of elytra very distinctly continued by smooth spaces.

Var. *desertorum* (Lec. †), Mars. Elytral punctures very sparse and

much finer in the interstriæ, smooth lines very indistinct, external subhumeral closer to the marginal and relatively longer, first dorsal as long as the second.

Var. *orbiculatus*, Mars. Elytral punctures in the apical region sparse, scarcely extending in the interstriæ, external subhumeral parallel with the marginal and moderately long, first dorsal equal to the second.

Notwithstanding the remarkably different aspect of the types of *fimbriatus* and *orbiculatus*, I am compelled to unite them as varieties of one form. I have a large series before me, and every gradation can be detected between the forms above indicated.

Occurs abundantly in California, also in Nevada, Kansas, Arizona, Texas and Lower California.

S. acilinea, Mars. Mon., 1862, p. 477, pl. 16, fig. 36.

Oval, convex, piceous, shining, surface slightly bronzed. Head coarsely sub-rugosely punctulate, frontal stria broadly interrupted at middle. Thorax fimbriate, disc finely and sparsely punctulate, at sides more coarsely, and near the anterior angles more densely, and a narrow space along the basal margin coarsely punctured. Elytra at apical half punctured, punctures coarse, more dense and serrate near the tips of the outer striæ and extending in the interstriæ, and in the outer two to the base; external subhumeral short basal, internal feeble, disconnected, oblique humeral sub-obsolete; first dorsal extending to middle, second longer, third shorter than the first, abbreviated at base, fourth equal to first, arching at base, joining the sutural which is entire. Pygidium and propygidium densely and rather coarsely punctured. Anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .10 inch; 2.5 mm.

The only difference that I can detect between this and var. *desertorum* of the preceding species is the abbreviation of the third dorsal at base. The size given by Marseul, is evidently too great, as is shown by the figure, the measurement above being from the type.

One specimen is before me (type), collected in the United States (possibly Texas), without definite locality.

S. cœrulescens, Lec. Ann. Lyc. V., p. 169.

Broadly oval, moderately convex, surface sub-opaque, steel-blue, prothoracic epipleuræ, and legs rufous. Head densely punctured, frontal stria entire. Thorax with margins sparsely fimbriate, disc sparsely punctured, punctures gradually becoming more dense to the sides where they are coarser, and almost confluent. Elytra moderately coarsely punctured over the entire surface, punctures less dense in the scutellar and sutural regions, humeral space smoother; external subhumeral short close to the marginal, internal short apical, humeral obliterated by punctures; first dorsal extending two-thirds to apex, second slightly longer, 3–4 gradually shorter, the latter arching at base, joining the sutural which is entire. Pygidium and propygidium densely and moderately

coarsely punctured. Anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .14 inch ; 3.5 mm.

Easily known by its sub-opaque, steel-blue surface, punctured over its entire extent.

One specimen, California.

S. vestitus, Lec. Ann. Lyc. V., p. 168.

Oval, feebly convex, piceous, opaque. Head moderately densely punctured, frontal stria interrupted at middle. Thorax with margins sparsely fimbriate, surface moderately coarsely punctured, punctures denser at the sides, but not rugose. Elytra moderately coarsely and equally punctured, over the entire surface, but not densely ; external subhumeral short basal, internal feeble disconnected ; first dorsal extending slightly beyond the middle, 2–3–4 gradually shorter, 2–3 hooked at base, fourth arched, joining the entire sutural. Pygidium and propygidium sparsely, but not densely punctured. Body beneath, and legs reddish-brown, anterior tibiæ multidenticulate, middle and hind tibiæ spinulose. Length .07–.10 inch ; 1.75–2.50 mm.

Occurs in California near San Francisco, rare.

Group VIII.

Species usually of robust facies. Front distinctly margined. Prosternum moderately compressed, foveate at tip, striæ usually entire, convergent in front. Anterior tibiæ rather coarsely denticulate, middle and hind tibiæ biseriately spinulose.

The species of this group may be readily distinguished by the following table :

Elytra with distinct sutural stria.
- Sutural stria entire, punctured space at apex of small extent ; dorsal striæ not entering the punctures..... sphæroides.
- Sutural stria abbreviated at apex, or confused.
  - Elytral punctures apical only, basal region impunctured.
    - Thorax strigoso-punctate at sides and apex ; elytra densely punctured at apex and sub-opaque ; surface bronzed ..... seminitens.
    - Thorax sparsely punctured at sides ; elytra sparsely punctured ; color brownish, shining, not bronzed.... ferrugineus.
  - Elytral punctures dense, extending to base between the striæ, scutellar mirror more or less defined.
    - Elytra coarsely punctured.
      - Mirror sharply defined ; sutural stria entire, confused at tip..... fraternus.
      - Mirror not defined ; sutural stria obsolete at apex..... mancus.
    - Elytra strigoso-aciculate..... bigemmeus.

Elytra with sutural stria wanting.
- Scutellar mirror well defined ; fourth dorsal distinct.... Fitchii.
- No scutellar mirror ; fourth dorsal and arc obliterated. estriatus.

S. sphæroides, Lec. Bost. Journ. V., p. 78, pl. 6, fig. 5 ; Mars. Mon., 1855. p. 719, pl. 20, fig. 154 ; *bigener*, Lec. loc. cit., p. 77, pl. 6, fig. 3.

Surface bronzed or cupreous. Head distinctly margined in front, smooth, and with a faintly marked chevron. Thorax sparsely punctured in front and at the sides, basal margin more coarsely punctured, disc smooth. Elytra punctured at apex, punctured space extending to the middle along the suture ; external subhumeral moderately long, humeral finely impressed, not uniting with the internal subhumeral ; first dorsal long, extending four-fifths to apex, and sinuate at tip ; striæ 2–3–4 gradually shorter, the latter arching at tip, joining the sutural which is entire. Propygidium moderately but not densely punctured, Anterior tibiæ coarsely denticulate, the apical three teeth much shorter than the others ; middle and hind tibiæ biseriately finely spinulose. Length .10–.14 inch ; 2.5–3.5 mm.

Occurs in the Middle States and Canada, on the banks of streams or on the sea shore.

S. seminitens, Lec., New Species, 1863, p. 61.

Surface bronzed, moderately shining. Head distinctly margined, front anteriorly rugulose. Thorax punctured and at sides finely strigose, base coarsely punctured, impunctured space short and very transverse. Elytra with large space moderately coarsely and densely punctured, extending in front of middle, and enclosing the tips of the striæ, scutellar space smooth, shining, interstrial space, sub-opaque ; external subhumeral moderate, parallel with the marginal, humeral obsolete, internal subhumeral moderately impressed ; first dorsal extending four-fifths to apex, striæ 2–3–4 gradually shorter, the latter arching at base, joining the sutural which extends two-thirds to apex. Pygidium and propygidium moderately densely and coarsely punctured. Legs reddish-brown, tibiæ as in the preceding species. Length .12 inch ; 3 mm.

One specimen, Nebraska. The interstrial space in this as in the preceding species, is impunctured.

S. ferrugineus, Mars. Mon., 1855, p. 712, pl. 19, fig. 148.

Oblong oval, moderately convex, rufo-ferruginous shining. Head smooth, front margined, and with a very faintly impressed chevron. Thorax very sparsely and finely punctured at the apex and sides, and a few coarser punctures along the base. Elytra very sparsely punctured at apex, punctures extending slightly in front of middle, external subhumeral stria absent, oblique humeral finely impressed, internal subhumeral short, disconnected ; first dorsal extending to middle, second to two-thirds, third slightly longer than the first, fourth shorter, arching at base, joining the sutural which extends slightly beyond the middle, becoming finer at apex. Pygidium moderately convex, finely punctulate. Anterior tibiæ 5–6 denticulate, hind tibiæ biseriately spinulose. Prosternum carinate, striæ approximate. Length .09 inch ; 2.25 mm.

This species is easily recognized from this excellent description and

figure, by Marseul. The type is before me through the kindness of M. Marseul.

Occurs in Texas.

S. fraternus, Say. Journ. Acad., 1823, V., p. 40; Lec. Bost. Journ. V., p. 77, pl. 6, fig. 4; Mars. Mon., 1855, p. 701, pl. 19, fig. 140.

Broadly oval, convex, black, aeneous, subopaque. Head flat, front rugose at middle, and with two obsolete chevrons, stria entire. Thorax moderately densely punctured, punctures at the sides somewhat strigose, discal broad triangular space nearly smooth. Elytra densely punctured and opaque with a well-defined small scutellar mirror usually limited at the sides by the fourth dorsal; external subhumeral stria obsolete, internal entire, oblique humeral fine; first dorsal long, curved at tip, 2-3-4 extending nearly to the middle, and gradually shorter, fourth arching at base, joining the sutural which is entire, rarely somewhat confused at tip. Pygidium and progygidium very densely punctured. Anterior tibiæ 7-8 denticulate, middle and hind tibiæ spinulose. Length .14 inch; 3.5 mm.

Occurs on the Atlantic and Lake shores, abundant.

S. mancus, Say. Journ. Acad., 1823, V., p. 40; Mars. Mon., 1855, p. 706, pl. 19, fig. 143.

Broadly oval, convex, black, aeneous, subopaque. Head flat, front coarsely punctured, and with a single chevron limiting a smooth triangular space, stria entire. Thorax moderately densely punctured; punctures denser and strigose in front, and at the sides, less dense and finer on the posterior portion of the disc. Elytra densely punctured, punctures strigose, scutellar mirror not well defined; external subhumeral short, close to the marginal, internal long, nearly joining the fine oblique humeral; first dorsal long arcuate at tip, 2-3-4 attaining the middle, successively slightly shorter, fourth archi[illegible] at base, joining the sutural which extends to middle, its apical portion, and also the apical marginal stria obliterated. Pygidium and propygidium densely punctured. Anterior tibiæ six-denticulate, middle and hind tibiæ spinulose. Length .10–.14 inch; 2.5–3.5 mm.

Closely allied to the preceding species, but readily distinguished by the characters above given. The scutellar mirror varies in extent as well as in degree of definition, and in some specimens is almost entirely obliterated by strigosity.

Occurs in the Northern States and Canada.

S. bigemmeus, Lec. Ann. Lyc. V., p. 169; Mars. Mon., 1855, p. 707, pl. 19, fig. 144.

Surface distinctly bronzed. Head margined anteriorly, front rugoso-punctate. Thorax broadly punctured at the sides and in front, and more coarsely punctured along the base. Elytra densely strigoso-aciculate, opaque, mirrror small, well defined; external subhumeral very short, basal

humeral finely impressed, joining the internal subhumeral; first dorsal well defined, extending four-fifths to apex and sinuate at tip; second extending to middle, and finely impressed, third and fourth very finely impressed and rapidly shorter, the fourth arching at base, joining the sutural which extends two-thirds to apex, and is gradually obliterated by the punctures. Pygidium and propygidium moderately, and not densely punctured. Legs as in the preceding species. Length .08–.10 inch; 2–2.5 mm.

Occurs on the sea-coast, of California.

S. Fitchii, Mars. Mon., 1862, p, 494, pl. 13, fig. 50.

Surface distinctly bronzed. Head margined, front punctato-rugose. Thorax with a broad space at sides and apex coarsely punctured, at margin strigose, discal smooth space moderately well defined, basal margin coarsely punctured. Elytra densely and coarsely punctured, and opaque over the entire dorsal aspect, except a well defined scutellar mirror; external subhumeral obsolete, humeral fine, not joining the internal subhumeral which is moderately long; first dorsal nearly entire, well marked sinuous at tip, second short, indistinct, third obsolete, fourth very short arcuate at base, sutural entirely wanting. Propygidium and pygidium moderately but not very densely punctured. Legs as in the preceding species. Length .12 inch; 3 mm.

One of the best defined species of the group. One specimen from Lowell, Massachusetts, kindly presented by Mr. P. S. Sprague.

S. estriatus, Lec. Pacif. R. R. Rep., 1857, App. I., p. 36; Horn, Trans. Am. Ent. Soc., 1870, p. 139, pl. 1. fig. 12.

Black, subopaque. Head distinctly margined, front with one or two chevrons more or less obliterated. Thorax moderately densely punctured, and at the sides substrigose, disc with spaces of irregular form impunctured. Elytra densely and moderately coarsely punctured over the entire dorsal aspect excepting three small smooth spaces, the first humeral, and extending along the sides, the second small oval and slightly within and beneath the first, the third larger than the preceding and at one-third from the base; external subhumeral not distinct from the marginal, humeral obsolete, internal subhumeral moderately impressed, first dorsal obsolete at base, apical portion nearly entire, sinuate at tip; second, third and fourth striæ entirely wanting, sutural entirely obliterated at base, apical portion sometimes evident. Pygidium and progygidium moderately densely and finely punctured, the former with a median narrow space and apex much smoother. Legs as in *fraternus*. Length .12–.18 inch; 3-4.5 mm.

Oregon and California, not common.

Group IX.

Front distinctly margined. Prosternum compresso-carinate, striæ united in front, usually short, sometimes obsolete. Hind tibiæ with

moderately coarse spinules arranged in a triple series or densely and irregularly placed.

Hind tibiæ with moderately long spinules arranged in three series; thorax punctured or rugose at the sides.
Elytra with punctures in the apical region only.
Thorax with narrow space within the margin punctured.
Sutural stria entire; elytral punctures coarse.... patruelis.
Thorax with wide lateral and apical space strigose; sutural stria abbreviated ..... lucidulus.
Elytra densely and coarsely punctured, except a small scutellar space not well defined; thorax coarsely punctured over nearly the entire surface..... æneipunctatus.
Hind tibiæ with short spinules densely placed; thorax with basal margin only punctured.
Elytra sparsely punctured at apex only.
Elytral punctures coarse; marginal stria of mesosternum sinuous at middle.....dimidiatipennis.
Elytral punctures finer; marginal stria of mesosternum straight..... gaudens.
Elytra coarsely punctured over the greater part of the surface.
Elytra punctured over the entire surface; marginal thoracic stria not extending on the base; anterior tibiæ moderately denticulate..... serrulatus.
Elytra with impunctured space at base; marginal stria of thorax extending along the base; anterior tibiæ with two apical teeth very large..... sulcifrons.

S. patruelis, Lec. Bost. Journ. V., p. pl. fig.; Mars. Mon., 1855, p. 711, pl. 20, fig. 147; *Javeti*, Mars. loc. cit. p. 709, pl. 20, fig. 146.

Form robust, surface shining with bluish-green or slightly bronze lustre. Head distinctly margined, front smooth and with a chevron more or less marked. Thorax with a narrow band of punctures within the lateral margin extending usually along the apex; basal margin with a narrow space coarsely punctured. Elytra very coarsely but not densely punctured at apex, punctures extending along the suture two-thirds to apex; external subhumeral obsolete, humeral oblique, fine and long, internal subhumeral disconnected, short; first dorsal extending slightly beyond the middle, second shorter, third as long as first, fourth shorter than the preceding, and arched at base joining the sutural. Pygidium and propygidium sparsely and not coarsely punctured, the former smoother at apex. Anterior tibiæ six-denticulate, the apical three teeth much coarser, hind tibiæ biseriately spinulose. Length .10–.14 inch; 2.5–3.5 mm.

In this species the punctuation of the sides of the thorax varies, and its extent may be reduced to a small patch near the anterior angle.

Occurs from the Middle States to Kansas.

S. lucidulus, Lec. Ann. Lyc. V., p. 170; *barbipes*, Mars. Mon., 1857, p. 448, pl. 11, No. 33, fig. 150 b.

Oblong oval, black with slight tinge of bronze. Head distinctly margined, front smooth, with a well marked chevron. Thorax sparsely punctured on the disc, more densely at the sides and apex, where they become strigose. Elytra sparsely punctured at apex, punctures extending to the middle along the suture; external subhumeral wanting, humeral moderately impressed, joining the internal subhumeral which is moderately long; first dorsal extending two-thirds to apex slightly sinuous at tip, second and third longer, fourth shorter, arched at base joining the sutural, which extends slightly beyond the middle. Pygidium and propygidium coarsely and densely punctured. Legs as in the preceding species. Length .10 inch; 2.5 mm.

Occurs at San Diego, California.

S. æneipunctatus, Horn, Trans. Ann. Ent. Soc., 1870, p. 333.

Oblong oval, black, opaque, elytra with aeneous lustre at bottom of punctures. Head margined in front, with a faintly impressed chevron. Thorax moderately, coarsely and densely punctured over nearly the entire surface except a narrow lateral and small discal space. Elytra very densely and coarsely punctured over the entire surface except at humerus and sides, and more rarely a badly defined space on each elytron near the scutellum and beneath the arch; external subhumeral obsolete, humeral obliterated by punctures, internal subhumeral moderate; first dorsal long, indistinct, second short with an arc at base, third obsolete, fourth very short, uniting by an indistinct arc at base with the sutural, which extends very indistinctly two-thirds to apex. Propygidium and pygidium densely ond coarsely punctured. Anterior tibiæ 5 or 6-denticulate, apical three teeth very coarse; hind tibiæ distinctly triseriately spinulose. Length .12 inch; 3 mm.

The striæ of the elytra are nearly as much obliterated as in *estriatus*, from which it may be readily known by the form of prosternum and the armature of the hind tibiæ.

Occurs on the sea-coast near San Francisco, Cal.

S. dimidiatipennis, Lec. Ann. Lyc. I, p. 170; Bost. Journ. V., p. 75, pl. 6, fig. 1; Mars. Mon., 1855, p. 713, pl. 20, fig, 149; *palmatus*, Say. Journ. Acad., 1825, p. 42; Lec, loc. cit., p. 76; *desertorum* ‡, Mars. loc. cit., p. 715, pl. 20, fig. 151; *deserticola*, Mars. Mon., 1857, p. 443.

Form robust, black, shining, elytra usually black, sometimes obliquely divided, the inner portion black, the outer red. Head strongly margined, front smooth, with distinct chevron. Thorax smooth, shining with a narrow space of punctures along the base. Elytra sparsely punctured at apex, punctures extending to middle along the suture, and rarely beyond the third stria, lateral region sparsely punctured; external subhumeral moderately distinct, humeral fine, internal subhumeral not

joining the humeral, and broadly interrupted at its middle ; first dorsal extending to middle, second and third longer, fourth equal to the first, arching at base, joining the sutural which is entire. Pygidium and propygidium coarsely but sparsely punctured. Anterior tibiæ as in the preceding species, hind tibiæ densely and irregularly spinulose on the outer face. Length .12–.16 inch ; 3–4 mm.

Occnrs on the sea-coast of the Middle States region.

The two synonyms by Marseul, refer to the same insect, which is the nearly totally black form, which was given him as having come from the Rocky Mountains.

S. gaudens, Lec. Ann. Lyc. V., p. 165.

Oblong oval, black, shining, with slight tinge of bronze. Head distinctly, margined front smooth without chevron. Thorax smooth with very narrow space of punctures along the base. Elytra sparsely and moderately coarsely punctured at apex, punctures extending in front of middle ; external subhumeral very close to the marginal, humeral moderately long, internal subhumeral short, disconnected ; first dorsal extending slightly beyond the middle, second very nearly as long, third very short, fourth one-third the length of the elytra, arched at base, joining the sutural which is entire and deeply impressed. Pygidium sparsely and rather coarsely punctured. Tibiæ as in the preceding species, but with the first two teeth very close and the third more distant. Length .12 inch ; 3 mm.

Occurs on the California sea-coast, but is rare.

S. serrulatus, Lec. Ann. Lyc. V., p. 165.

Black, moderately shining, elytra brownish opaque. Head margined, front smooth, chevron feebly marked. Thorax smooth, sparsely punctured along the basal margin. Elytra very coarsely but not densely punctured over the entire surface, except a narrow space extending from the humerus along the outer side of the first dorsal stria ; external subhumeral distinct, humeral finely impressed, internal subhumeral disconnected, short; first dorsal extending to middle, second and third slightly longer, fourth shorter than the first, arching at base, joining the sutural which is entire. Pygidium and propygidium coarsely and moderately densely punctured. Anterior tibiæ 7–8-denticulate and more finely than usual in the group ; hind tibiæ densely clothed with short stout spinules. Length .14 inch ; 3.5 mm.

Occurs on the sea-coast at San Diego.

S. sulcifrons, Mann. Bull. Mosc.. 1843, II., p. 259 ; Mars. Mon., 1856, p. 101, pl. 3, No. 34, fig. 2.

Form robust, black, subopaque. Head distinctly margined, front with a feeble chevron. Thorax smooth, very convex, with a narrow line of punctures at base, marginal stria advancing along the base, and deeply impressed to the middle of each elytron. Elytra densely and coarsely punctured with smoother spaces at humerus, outer apical angle and

under the arch of the fourth dorsal; marginal stria arched at base; external subhumeral confounded with the marginal, humeral fine, internal subhumeral obliterated; dorsal striæ very short indistinct, except at base where all are more or less arched, fourth joining the sutural which extends very indistinctly nearly to apex. Pygidium and propygidium densely and coarsely punctured. Anterior tibiæ with two very coarse teeth at apex, above which the tibiæ are finely serrulate; hind tibiæ stout, densely spinulose. Length .18–20 inch; 4.5–5 mm.

Occurs on the sea-coast of California.

TERETRIUS, Erichs.

Body cylindrical, prosternum emarginate at tip, receiving the mesosternum, tibiæ denticulate. Antennæ frontal, antennal fossa at the sides of thorax under the anterior angle.

Two species only occur in our fauna.

Elytra with a short, very oblique stria at base..... obliquulus.
Elytra punctured without stria.....americanus.

T. obliquulus, Lec. Pacif. R. R. Rep., 1857, p. 36.

Oblong robust, piceous shining. Head sparsely punctured. Thorax sparsely punctured, punctures finer and slightly more dense at the sides, marginal stria entire ending abruptly at base. Elytra sparsely punctured, punctures finer toward the sides, subhumeral space smooth, at base a short, very oblique moderately impressed stria. Pygidium moderately coarsely, but not densely punctured. Prosternum broad, broadly emarginate in front, acutely notched behind, mesosternum with entire marginal line, coarsely and sparsely punctured. Anterior and middle tibiæ 6-denticulate, hind tibiæ 4-spinose. Length .10 inch; 2.5 mm.

Occurs near Sacramento, California.

T. americanus, Lec. Proc. Acad, 1859, 316; *picipes* ‡, Lec. Bost. Journ. V., p. 79, pl. 6, fig. 6.

Oblong, moderately robust, piceous shining. Head sparsely punctured. Thorax sparsely and moderately coarsely punctured, punctures finer at the sides, marginal stria entire, extending slightly along the base very close to the margin. Elytra sparsely and moderately coarsely punctured, punctures coarser at base, subhumeral smooth space small. Pygidium and propygidium moderately coarsely but sparsely punctured. Prosternum subtruncate in front. Anterior tibiæ 5–6 denticulate, middle tibiæ more coarsely 5-dentate, hind tibiæ bispinose at apex. Length .06–.08 inch; 1.5–2 mm.

This species is very closely allied to the *picipes* of Europe, and appears to differ only in the greater distinctness of the lateral margin of thorax, and by the incurved end of the marginal stria being closer to the base so that the slight groove seen in the European form is obliterated. It is probable that with more specimens this slight difference would disappear.

Widely distributed, but appears to be rare.

TERETRIOSOMA, n. g.

Form subcylindrical, short, obtuse.

Head deeply inserted, vertex convex, front inflexed; no frontal stria.

Antennæ inserted on the front, antennal fossa broad and shallow, situated on the underside of thorax in front of the coxæ.

Prosternum short, broad, without striæ, anteriorly subtruncate, posteriorly emarginate; mesosternum prominent in front, received by the prosternum, and with entire marginal line.

Thorax nearly as long as the elytra, subquadrate, anteriorly emarginate, at base broadly rounded.

Elytra punctured. Scutellum minute.

Propygidium transverse short. Pygidium double, upper portion, transversely oval, feebly convex, inferior portion longitudinally concave, transversely scarcely convex.

Anterior tibiæ slender at base, dilated at apex, exteriorly finely serrulate with many spinulose teeth, middle and hind tibiæ similar, the latter with the spinules less densely placed. Tarsi bi-unguiculate.

This genus is closely allied to *Teretrius* and *Xiphonotus*, and apparently nearly intermediate between the two. From the former it differs especially by the double pygidium, and from the latter by the absence of the prothoracic projection in front, and the two claws to all the tarsi, and the form and armature of the tibiæ. The vertex and front are not in the same continuous curve, but the latter is flat and more strongly inflexed than the former, and longitudinally concave.

T. chalybæum, n. sp.

Form subcylindrical, short, obtuse, surface shining bluish with slight tinge of green, sparsely, equally, and not coarsely punctured, antennæ and legs reddish-brown. Thorax subquadrate, slightly broader than long, sides feebly arcuate, and slightly convergent in front. Elytra slightly longer than the thorax, and scarcely longer than wide, at base slightly impressed. Propygidium transverse, punctured similarly to the elytra. Pygidium double, basal portion more than twice as wide as long, and at distal end arcuate, surface similar in color and punctuation to the propygidium; apical portion viewed directly in front, crescentic, vertically slightly concave, transversely scarcely convex, surface piceous, less distinctly punctured and subopaque. Prosternum as broad as long, moderately convex, sparsely and coarsely punctured. Meso- and metasternum coarsely and sparsely punctured, the suture obliterated. Length .12 inch; 3 mm. Plate 5, fig. 9.

One specimen, Texas, received from Dr. Summers, of New Orleans.

PLEGADERUS, Erichs.

Plegaderus may be readily known from all the genera of Histeridæ by the structure of the prosternum. The prosternum is broad and has on each side a broad, deep channel extending from the lobe to the tip,

slightly arcuate, so that the two approach slightly at middle, and also a broad transverse groove which divides the median convex portion of the prosternum into two unequal portions. The lateral grooves extend also on the meso- and metasternum, and are there divergent, running parallel with the sutures. On the outer side of the grooves, and limiting them in their entire length is a ridge more or less acute as the groove is broader, and in *P. Sayi*, the ridge approaches so closely to the lateral carina of the prosternum, especially in front that the channel which usually exists between the two ridges is entirely obliterated. In consequence of this in separating our species (Trans. Am. Ent. Soc., 1870, p. 142), I described *Sayi* as having a single sulcus on each side and *nitidus* and *fraternus* two on each side. This method of expression is however faulty and may mislead, and should therefore be lost sight of.

The following table will serve to distinguish our species :

Transverse thoracic impression usually obliterated, rarely visible at the sides; meso-metasternal plate sparsely punctured.

Elytral punctures round, coarse and sparsely placed..... Barbelini.

Transverse thoracic impression entire and moderately deep.

Elytra strigoso-punctate.....transversus.

Elytra coarsely punctured, punctures round, not strigose.

Body beneath coarsely and rather closely perforato-punctate..... Sayi.

Body beneath very sparsely punctate.

Transverse sulcus of prosternum scarcely broader than the lateral sulci, posterior division of prosternal carina of moderate extent, the anterior elongate oval. Thorax moderately coarsely but not densely punctured. Laternal sulcus of pronotum entire.

Posterior portion of prosternal carina trapezoidal.. consors.

Posterior portion of prosternal carina triangular..... fraternus.

Transverse sulcus of prosternum very broad, wider than the lateral sulci, posterior division of prosternal carina very minute, anterior transverse. Thorax very sparsely and finely punctulate. Lateral sulcus of pronotum not attaining the base..... nitidus.

P. Barbelini, Mars. Mon., 1862, p. 684; 1861, pl. 4, No. 46, fig. 2; *pusillus*‡, Lec. Bost. Journ. V., p. 80, pl. 6. fig. 8; *Erichsonii*, Lec. List, p. 28.

Oblong oval, moderately convex, brownish, shining. Head finely and not densely punctured, front slightly concave transversely. Thorax subquadrate, slightly broader than long, base not margined, lateral groove deep, not quite attaining the basal margin, marginal space convex, not interrupted; disc with slight trace of transverse impression at the sides near the anterior third, frequently entirely wanting; surface sparsely punctured, marginal space more densely and coarsely. Elytra coarsely

and not densely punctured, punctures round and distinct; marginal stria short, extending to middle and deeply impressed,* and at humerus a slight trace of an oblique stria. Propygidium and pygidium sparsely and moderately coarsely punctured. Anterior tibiæ finely spinulose, middle and hind tibiæ ciliate. Prosternum on each side deeply sulcate, median convex portion broadly divided transversely by a deep sulcus ciliate at bottom, anterior division broadly oval, coarsely, but sparsely punctured, posterior portion small, narrow, cariniform. Mesosternal plate coarsely but very sparsely punctured. The two sulci are united in front by a fine transverse groove parallel with, and close to the anterior margin of the prosternum. The lateral ridge of the prosternum is moderately distant from the ridge bounding the sulcus externally, and the space between them is sulciform and smooth. Length .04 inch; 1 mm.

Occurs abundantly in North and South Carolina. Marseul's name has priority by one year, and must be adopted.

P. transversus, Say. (*Hister*), Journ. Acad. V., 1825, p. 45; Lec. Bost. Journ. V., p. 80. pl. 6, fig. 7; Mars. Mon., 1856, p. 277, pl. 22, fig. 9.

Oblong oval, brown, moderately shining. Head sparsely punctured, front transversely slightly concave. Thorax slightly broader than long, marginal stria deep, lateral sulcus entire, moderately deep, gradually less impressed to base, margin convex, not interrupted, more densely punctured at the anterior angles; disc divided unequally by a moderately impressed transverse sulcus, anterior portion smaller, and more closely punctured than the posterior, punctures sparsely placed and of elongate form. Elytra strigoso-punctate, more densely near the humeral angles, at humerus a short oblique stria moderately impressed; marginal stria short basal. Pygidium coarsely and moderately densely punctured. Prosternum as in the preceding species, but with the portion behind the transverse sulcus slightly more distinct. Length .05 inch; 1.25 mm.

Occurs from Canada to Texas, more abundant in the Gulf and Southern Atlantic States.

P. Sayi, Mars. Mon., 1856, p. 269, pl. 11, No. 38, fig. 7.

Oblong oval, brownish, shining. Head sparsely punctulate, front transversely slightly concave. Thorax slightly broader than long, marginal stria moderately deep, lateral sulcus entire, marginal space convex, not interrupted, coarsely and rather densely punctured; disc unequally divided by moderately deep transverse sulcus, anterior portion more finely and densely punctured than the posterior. Elytra coarsely and rather closely punctured, suture slightly elevated, oblique humeral and one dorsal stria short, rudimentary, marginal short basal. Pygidium and propygidium densely and coarsely punctured. Metasternal plate densely

* Marseul calls the short stria an *internal* marginal stria, but from the position of the two striæ, I find that the short stria is really the marginal, while the other of which he speaks, composed of coarse punctures, is really a portion of the sculpture of the side pieces of the meso- and metasterna.

and coarsely perforato-punctate. Prosternal sulci deep, broad, transverse sulcus not wider than the lateral, anterior portion of prosternum oval, coarsely punctured, posterior portion oval, truncate in front; lateral carina of prosternum confluent with the ridge limiting the sulcus before attaining the front of prosternum. Length .06 inch; 1.5 mm.

This species is readily known by the very coarsely perforato-punctate meso-metasternal plate.

Not common. Occurs in the Middle States.

P. consors, n. sp.

Oblong oval, black, shining. Head sparsely punctulate, front slightly concave transversely. Thorax slightly broader than long, marginal stria moderately deep, lateral sulcus moderately deep, entire, marginal space convex, sparsely punctured; disc unequally divided by a transverse sulcus, anterior portion slightly more than half the posterior and more finely but not more densely punctured. Elytra coarsely but not densely punctured, suture slightly elevated, at base a short oblique humeral and rudimentary dorsal; marginal stria feeble extending one-third to apex. Pygidium moderately, neither coarsely nor densely punctured. Metasternum sparsely punctured. Prosternum nearly as in *Sayi*, posterior portion of carina broader than long, trapezoidal, lateral carina of prosternum extending entirely to apex. Length .05 inch; 1.25 mm.

Narrower and less convex than *Sayi* and with the meso-metasternal plate very sparsely punctured.

One specimen, Colorado.

P. fraternus, Horn, Trans. Am. Ent. Soc., 1870, p. 141.

Oblong oval, brownish, moderately shining. Head sparsely punctured and slightly transversely concave. Thorax slightly broader than long, marginal stria moderately deep, lateral sulcus entire, marginal space convex, sparsely punctured, more densely in front; disc unequally divided by a transverse sulcus less distinct at middle, surface sparsely punctured, the anterior division more finely. Elytra sparsely punctured, punctures coarse, round and deeply impressed, suture slightly elevated, at base with short oblique humeral and rarely a rudimentary dorsal, marginal short moderately deeply impressed. Pygidium moderately coarsely and densely punctured. Metasternal plate sparsely punctured. Prosternum nearly as in *Sayi*, the portion behind the transverse sulcus oval, subacute in front, lateral ridge entire, the space between it and the marginal ridge of the sulcus not channeled. Length .05 inch; 1.25 mm.

Smaller than the preceding species and relatively broader. Differs especially in the form of posterior division of the prosternum which results from a narrower transverse sulcus.

Occurs in California and Nevada.

P. nitidus, Horn, Trans. Am. Ent. Soc., 1870, p. 141.

Oblong oval, black, shining. Head sparsely punctulate, front transversely slightly concave. Thorax slightly broader than long, marginal stria

moderately impressed, lateral sulcus moderately deep in front, gradually shallower behind and not attaining the basal margin, marginal space moderately convex, sparsely punctured, more densely in front, disc sparsely and finely punctured, unequally divided by transverse sulcus. Elytra frequently with two rudimentary dorsal and oblique humeral striæ, surface sparsely and rather finely punctured; marginal stria fine extending one-third. Pygidium moderately coarsely but not densely punctured. Metasternum sparsely punctured. Prosternal sulci broad, deep, transverse sulcus much broader, anterior prosternal division transversely oval, posterior small, obtusely cariniform. Length .07–.09 inch; 2–2.5 mm.

One of our most distinct species, easily known by its black, shining, sparsely and rather finely punctured surface.

Occurs in Nevada and Oregon; in the latter place collected rather abundantly by Lord Walsingham.

Bacanius, Lec.

Frontal suture distinct. Eyes coarsely granulated. First joint of antennæ gradually thicker to the tip, second joint broader than long, rhomboidal, third longer than the two following, antennal fossa as in Dendrophilus. Prosternum broader than long, at tip truncate, lobe nearly as long as the prosternum, mesosternum truncate. Anterior tibiæ dilated and bidenticulate, middle and hind tibiæ dilated, but less than the anterior.

The species of this genus are all minute and are thus distinguished:

Prosternum and mesosternum smooth sparsely punctured, mesosternal stria visible at the sides, obliterated at middle. Elytral punctures simple.
- Elytra with subhumeral and first dorsal entire. Epipleural fold smooth, impunctured. Pygidium very minutely punctulate..... misellus.
- Elytra with subhumeral abbreviated at apex, first dorsal short. Epipleural fold sparsely punctured. Pygidium punctured..... tantillus.

Prosternum and mesosternum coarsely foveato-punctate, mesosternal stria entirely obliterated. Subhumeral stria wanting, first dorsal entire, broadly arching at base and returning. Epipleural fold coarsely punctured. Pygidium coarsely punctured. Elytral punctures substrigose..... punctiformis.

B. misellus, Lec. Proc. Acad., 1853, p. 292; Mars. Mon., 1856, p. 573, pl. 14, No. 41, fig. 3.

Broadly oval, subglobose, brownish-red, moderately shining. Head very sparsely and minutely punctulate. Thorax sparsely and finely punctured. Elytra more coarsely punctured, punctures simple and sparsely placed, subhumeral stria entire, first dorsal entire, more deeply impressed than the subhumeral. Pygidium shining, very sparsely and

finely punctulate. Meso-metasternal plate shining, very minutely punctulate. Legs paler than the under surface. Length .03 inch; .75 mm.

Occurs in the Middle States region.

B. tantillus, Lec. loc. cit., p. 291.

Larger, more broadly oval and less convex than the preceding species. Thorax more coarsely punctured. Elytra with subhumeral stria abbreviated at base and subobsolete at apex, first dorsal apical, attaining the middle only. Pygidium coarsely punctured. Meso-metasternal plate sparsely punctured. Length .04 inch; 1 mm.

Occurs from Pennsylvania to Louisiana.

B. punctiformis, Lec. loc. cit., p. 288.

Similar in form to *misellus*. Thorax similarly punctured. Elytra without subhumeral stria, first dorsal entire broadly arching at base, surface densely aciculately punctured and with a substrigose aspect. Pygidium coarsely but not densely punctured. Meso-metasternal plate densely foveato-punctate. Length .03 inch; .75 mm.

Occurs in Pennsylvania, Florida, Missouri.

ACRITUS. Lec.

This genus contains the most minute species of the family. It may be at once known by the four-jointed hind tarsi. *Bacanius* bears a superficial resemblance to *Acritus*, but may be known by the five-jointed hind tarsi, the prosternum slightly lobed in front and without striæ, and the form of the tibiæ. They have in common, however, the prominent, coarsely granulated eye, in front of which the antennal scape is lodged, when at rest, in a deep groove.

The four-jointed hind tarsus results from the union of the first two joints, consequently the first joint thus formed is long, always equal to the two following united, and in the majority of cases much longer. The scutellum is small and difficult to see from the very fine sutures between it and adjacent parts, and although small it is proportionately as large as in many *Saprinus*. Several species I find to be totally deprived of scutellum between the basal angles of the elytra; these I have separated as a distinct genus.

As thus restricted our species are as follows:

Thorax without basal transverse row of punctures.

Anterior tibiæ rather broadly dilated. Prosternum much longer than wide at base, striæ in front strongly divergent, at base parallel ..... maritimus.

Anterior tibiæ scarcely broader than the middle.

Prosternum scarcely longer than wide at middle; elytra finely punctured ..... Arizonæ.

Prosternum twice as long as wide; elytra sparsely punctured ..... exiguus.

Thorax with basal transverse row of punctures.

Prosternum scarcely longer than wide; marginal striæ of mesosternum interrupted.

Basal row of punctures short, arcuate; mesosternum slightly concave longitudinally sulcate; meso-metasternal suture obliterated..... Floridæ.
Basal row of punctures long, nearly straight; mesosternum flat, meso-metasternal suture distinct.
Form orbicular; metasternum sparsely and finely punctured..... discus.
Form oval; metasternum coarsely punctured..... fimetarius.
Prosternum much (usually twice) longer than wide; mesosternal stria entire.
Elytra with very deep humeral and dorsal striæ; thorax very minutely and sparsely puncticulate..... Sallei.
Elytra with scarcely a trace of striæ; thorax moderately punctured.
Prosternal striæ not more divergent in front than at base, elytral punctures much less distinct at base. strigosus.
Prosternal striæ more divergent in front, elytral punctures as deep at base as at middle..... acaroides.

A. maritimus, Lec. Ann. Lyc. V., p. 170; Proc. Acad., 1853, p. 290.

Oblong, feebly convex, brownish-black, shining. Head sparsely punctulate. Thorax sparsely and finely punctured. Elytra moderately coarsely, but not densely punctured, punctures feebly strigose at apex; disc with faint oblique dorsal stria extending nearly to the middle of the margin; marginal stria deeply impressed, entire; suture slightly channelled at base. Pygidium smooth shining. Prosternum much longer than wide at base, striæ posteriorly parallel, anteriorly very strongly divergent, surface feebly shining, very finely alutaceous. Mesosternal stria entire. Anterior tibiæ dilated, anterior face slightly concave, outer margin finely spinulose. Length .045 inch; 1 mm.

Occurs in California. It is the largest species in our fauna. The measurement above is the entire length, and it is really more than 1 mm. long.

A. Arizonæ, n. sp.

Broadly oval, convex, brownish-black, shining. Head sparsely punctulate. Thorax sparsely punctured, punctures at apex fine, becoming gradually coarser to base. Elytra rather sparsely and moderately finely punctured, punctures finer at apex; disc with a short scarcely evident humeral and dorsal stria not attaining the base, marginal stria fine. Pygidium very sparsely punctulate. Prosternum broad, nearly as wide at middle as long, surface sparsely punctured. Mesosternum moderately punctured, marginal stria interrupted, metasternal suture distinct. Metasternum sparsely punctulate. Anterior tibiæ scarcely broader than the middle. Length .04 inch; 1 mm.

Occurs in Arizona, at Camp Grant, under Cottonwood bark.

A. exiguus, Erichs. Jahrb., 1834, p. 208; Lec. Proc. Acad., 1853, p.

291; Mars. Mon, 1856, p. 603, pl. 14, No. 11, fig. 3; *aciculatus*, Lec. Bost. Journ. V., p. 84, pl. 6, fig. 10; Mars. Mon., loc. cit., fig. 2; *obliquus*, Lec., loc. cit., fig. 12; *cribripennis*, Mars. Mon., 1856, p. 605, pl. 14, No. 43, fig. 5; *Natchez*, Mars., loc. cit., p. 604, fig. 4.

Oblong oval, brownish, slightly convex, shining. Head sparsely punctulate. Thorax moderately coarsely and sparsely punctured. Elytra more coarsely but not more densely than the thorax, marginal stria moderately deep, entire. Pygidium finely and sparsely punctulate. Prosternum more than twice as long as wide, surface with very few punctures. Mesosternal stria interrupted at middle, meso-metasternal plate rather coarsely but sparsely punctured. Anterior tibiæ slender. Length slightly less than .04 inch; 1 mm.

After a careful study of the types of all the above synonyms, I confess myself unable to separate them. *Natchez* is said to have the mesosternum with an entire marginal stria, but I am thoroughly convinced that the stria is not entire and that the appearance is entirely owing to a very slight elevation of the anterior edge of the mesosternum, against which the tip of the prosternum abuts. The presence of the dorsal stria on which *obliquus*, *aciculatus* and *cribripennis* have been founded, is a character of no value whatsoever here, as every variation occurs from a moderate stria touching the base, to a shorter stria not attaining the base, and from this to no stria at all.

Occurs not uncommonly in the Middle, Southern and Western States, under bark.

A. Floridæ, Mars. Mon., 1862, p. 693, pl. 4, No. 51, fig. 2.

Orbicular, feebly convex, piceous, shining. Head sparsely punctulate. Thorax moderately, densely, and coarsely punctured at base, with a short row of closely approximate punctures, arcuate, and terminating within the middle of the elytra. Elytra more coarsely punctured than the thorax at base; punctures less distinct, at middle and near apex slightly strigose; marginal stria fine, entire; two very short striæ at base, very feebly impressed. Pygidium finely and not densely punctured. Prosternum scarcely longer than broad, sparsely punctured. Mesosternum slightly concave, surface longitudinally sulcate, stria interrupted. Metasternum sparsely punctured, suture obliterated. Anterior tibiæ slender. Length .04 inch; 1 mm.

More elongate and convex than *discus*, but equal in size. Occurs in South Carolina, Florida (Marseul), Louisiana (Sallé).

A. discus, Lec. Proc. Acad., 1853, p. 289.

Orbicular, brownish, moderately convex, shining. Head sparsely and minutely punctulate. Thorax finely punctured, at base a transverse, nearly straight, row of punctures extending nearly to the basal angles. Elytra moderately punctured, more coarsely than the elytra and finer and slightly aciculate at apex, marginal stria fine, entire, slightly sinuous at base, and with a very faint trace of a dorsal stria. Pygidium subopaque, finely alutaceous. Prosternum scarcely longer than wide

at middle, coarsely but sparsely punctured. Mesosternum flat, coarsely punctured, stria interrupted, metasternum finely alutaceous, sparsely punctured, suture fine but distinct. Legs pale rufous, anterior tibiæ slender. Length .04 inch ; 1 mm.

Occurs in Georgia, under bark.

A. fimetarius, Lec. Bost. Journ. V., p. 84 ; Mars. Mon., 1856, p. 615, pl. 14, No. 43, fig. 14.

Oval, moderately convex, piceous, shining. Head sparsely and minutely punctulate. Thorax sparsely and finely punctulate, at base a transverse, nearly straight row of punctures extending beyond the middle of each elytra. Elytra sparsely punctured, more coarsely than the thorax, at apex slightly aciculate, marginal stria entire, moderately deep. Pygidium finely transversely strigose and sparsely punctured. Prosternum scarcely longer than wide, sparsely punctured, mesosternum flat, coarsely punctured, stria interrupted, metasternum coarsely punctured, suture distinct. Anterior tibiæ slightly dilated at apex. Length .04 inch ; 1 mm.

Scarcely as long as *discus*, but more oval and convex, and with the elytra more coarsely punctured with deeper marginal stria.

Occurs in the Middle and Southern States.

A. Sallei, n. sp.

Oval, convex, brownish, shining. Head minutely punctulate. Thorax very finely and sparsely punctured, at base a short row of punctures, nearly straight close to the basal margin and not attaining the middle of the elytra. Elytra coarsely punctured, punctures finer and slightly aciculate at apex, disc with two oblique very deeply impressed striæ, the inner longer and extending to middle and between the tips of the two striæ the rudiment of another, marginal stria deep, entire. Pygidium finely alutaceous. Prosternum nearly twice as long as wide at middle, very sparsely punctured. Mesosternal stria entire, meso- and metasternum coarsely punctured, suture very fine. Anterior tibiæ slender. Length .03 inch ; .75 mm.

Closely allied to *strigosus*, but differs by the much more finely punctured thorax, deep dorsal and marginal stria. The latter stria is very much deeper at base, and there appears to be an additional stria at that point, parallel with and very close to it. In size it is equal to *strigosus*.

Georgia and Louisiana. Respectfully dedicated to M. Aug. Sallé, Paris, whose kindness during the progress of this paper has already been acknowledged.

A. strigosus, Lec. Proc. Acad., 1853, p. 289 ; Mars. Mon., 1856, p. 619, pl. 14, No. 43, fig. 19 ; *conformis*, Lec., loc. cit. ; *lateralis*, Mars. Mon., 1856, p. 621, pl. 14, No. 43, fig. 21.

Oval, moderately convex, brown, shining. Head sparsely and finely punctulate. Thorax sparsely and moderately finely punctured, and with a basal row of fine punctures not extending beyond the middle of the elytra. Elytra coarsely punctured, punctures at apex strigose, marginal

stria fine, disc with or without faint traces of an oblique dorsal stria. Pygidium finely alutaceous. Prosternum nearly twice as long as wide, striæ not more divergent in front, surface with a few punctures. Mesosternal stria entire, meso- and metasternum coarsely punctured, the latter less so, suture fine. Tibiæ slender. Length .03 inch; .75 mm.

I am totally unable to appreciate the differences between *lateralis*, Mars., and *strigosus*, Lec., and after a careful examination of the species, believe *conformis* to be merely a somewhat smoother form.

Occurs in the Southern States.

A. acaroides, Mars, Mon., 1856, p. 618, pl. 14, No. 43, fig. 18.

Oval, convex, piceous, shining. Head sparsely punctulate. Thorax finely and moderately densely punctured, basal row of punctures moderately coarse, close to the margin and short. Elytra coarsely punctured, punctures strigose at apex, marginal stria moderately deep. Pygidium extremely finely alutaceous. Prosternum longer than wide at middle, striæ divergent in front. Mesosternal stria entire, meso- and metasternum coarsely punctured, suture fine but distinct. Tibiæ slender. Length .05 inch; 1.25 mm.

I have the type alone before me. Closely allied to *strigosus*.

Occurs in the Southern States.

A. atomus, Lec., cited by Marseul from New Orleans, is from Cuba.

ÆLETES, n. g.

The absence of scutellum is the only character separating the species below from Acritus.

They are as follows:

Surface smooth, impunctured.	
Prosternum twice as long as wide.....	politus.
Prosternum nearly as wide as long.....	brevisternus.
Surface punctured. Thorax with basal row of punctures.	
Basal row of punctures short, arcuate.....	basalis.
Basal row of punctures straight, long.....	simplex.

A. politus. Lec. Proc. Acad., 1853, p. 290; Mars. Mon., 1856, p. 610, pl. 14, No. 43, fig. 10.

Oval, convex, brown, shining, impunctured. Prosternum twice as long as wide. Mesosternum longitudinally sulcate, stria obliterated at middle, suture not evident. Length .03 inch; slightly less than 1 mm.

Occurs in the Middle, Southern and Western States.

A. brevisternus, Mars. Mon., 1856, p. 609, pl. 14, No. 44, fig. 9.

Oval, convex, brownish, shining, impunctured. Prosternum scarcely longer than wide. Mesosternum with stria interrupted, surface nearly impunctured, suture indicated by a transverse row of coarse punctures, the punctures finer at the sides and elongate in the middle. Length .035 inch; .8 mm.

One specimen, the type, is before me. Occurs in Louisiana.

A. basalis, Lec., Ann. Lyc. V., p. 170; Proc, Acad. 1853, p. 290.

Oval, moderately convex, piceous, shining. Head sparsely and finely punctulate. Thorax moderately punctured at base with a row of punctures strongly arcuate at middle, and slightly prolonged along the basal margin. Elytra moderately punctured, punctures coarser than those of the thorax, marginal stria moderate. Pygidium shining, very sparsely punctulate. Prosternum as broad as long. Mesosternum with the stria interrupted, metasternum sparsely punctured. Length .04 inch; 1 mm.

The punctures forming the arcuate line of the base of the thorax are longitudinally prolonged, and the base of the thorax is apparently sulcate.

Occurs in the region near Fort Yuma, Cal.

A. simplex, Lec. Bost. Journ. V., p. 84, pl. 5, fig. 11; Mars. Mon., 1856, p. 620, pl. 14, No. 43, fig. 20; *acupictus*, Mars. loc. cit. p. 618, fig. 17.

Oval, brownish, moderately convex, shining. Head minutely punctulate. Thorax sparsely and finely punctured, basal row of punctures long, slightly arcuate at middle, punctures at middle sulciform. Elytra sparsely punctulate, punctures fine and aciculate, marginal stria fine. Pygidium smooth. Prosternum nearly as broad as long. Mesosternum and metasternum smooth, suture indicated by a row of coarse punctures, coarser at middle. Length .04 inch; 1 mm.

I have carefully compared the types of Marseul and Leconte, and find them identical, although *simplex* is said by Marseul to have a narrower prosternum. This is certainly not the case in any specimen examined by me. This and the preceding species are closely allied, but differ in the thoracic and elytral punctuation and also by the more strongly arcuate basal line of the former.

Occurs principally in the Southern States.

EXPLANATION OF PLATE V.

FIG. 1. Hister æneomicans Horn.
" 2. Tribalister marginellus Lec.
" 3. Hetærius morsus Lec.
" 4. Echinodes setiger Lec.
" 5. Paromalus mimeticus Horn.
FIG. 6. Saprinus interstitialis Lec.
" 7. " Copei Horn.
" 8. " æquipunctatus Horn.
" 9. Teretriosoma chalybæum Horn.

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CONTRIBUTIONS FROM THE LABORATORY OF THE UNIVERSITY OF PENNSYLVANIA.

NO. I.

CORUNDUM,

Its Alterations and Associated Minerals.

(*Read before the American Philosophical Society, September 19th*, 1873.)

By F. A. Genth.

At the meeting of the American Philosophical Society of April 21st, 1871, I have exhibited and described several peculiar crystals of corundum, either wholly or partly altered into other mineral species. The chemical examination of these and many others, which I have since received, has given results and led to conclusions which, in connection with their paragenesis, are of not less interest to the chemist and mineralogist than to the geologist.

My information as to the occurrences of corundum in Europe and Asia is too limited to give a full outline of the same; I shall confine myself therefore, to those of *this* country and shall endeavor to give briefly the most striking geological features under which they have been observed.

The rocks of the Laurentian System contain but very little corundum, and only a few isolated crystals of white, red and blue colors have been found in the granular limestones belonging to this formation. It occurs, for example, associated with spinel, chondrodite, hornblende, graphite and numerous other minerals at Warwick and Amity, in the State of New York; at Newton, Vernon and Franklin in New Jersey.

The largest deposits of corundum known in the world, occur in the chromiferous serpentine or chrysolite formation, and in the rocks immediately adjoining the same. Numerous localities have been developed from Massachusetts to Alabama, and it will always be a very interesting question, by what agencies such enormous quantities of alumina could have been precipitated to form corundum, which, by its subsequent alteration has given rise to many of our most widely distributed minerals and rocks.

The most important corundum deposit in the Eastern States has been discovered by C. T. Jackson,* at Chester, Mass.; it was subsequently described by C. U. Shepard† and J. L. Smith.‡

It consists of crystalline corundum in a fine scaly chlorite, or of a peculiar mixture of granular and crystallized corundum with magnetite (which is generally titaniferous), intermixed with more or less of a chloritic mineral. The whole deposit traverses two mountains for about four miles, with an average thickness of four feet, and lies in a talcose slate and serpentine between gneiss and mica slate, in the centre of the

* C. F. Jackson, Sill. Journ. [2] XXXIX, 88.
† C. U. Shepard—Sill. Journ. [2] XL, 112-123; XLII, 421; XLVI, 256.
‡ J. L. Smith—Sill. Journ. [2] XLII, 83.

Green Mountains. The gneiss contains *no* corundum; the talcose rock, however, has grains of emery, corundum and magnetite disseminated through the whole mass; a vein of oligoclase (so-called indianite) many inches in thickness with small particles of corundum diffused through it, runs for many rods through the chloritic rock.

The corundum is generally in small brownish crystals, or very fine grains; the variety sapphire is sometimes met with in bi-pyramidal crystals; pinkish margarite, disapore and corundophilite frequently invest the corundum or emery, which is also associated with tourmaline, cyanite chloritoid, ilmenite, rutile, etc. With the oligoclase occurs a dark-green variety of biotite.

The views of Jackson, endorsed by Shepard, that the Chester (Mass.) emery was a distinct mineral species and that it had the composition of hercynite, FeO, Al_2O_3, has already been refuted by J. L. Smith.

I will here mention a few other New England localities of corundum, although they may not belong to the chromiferous serpentine region.

J. H. Adams* observed it in small quantity and rarely in situ at Pelham, Mass., in flattened masses of a brownish-black mica (Biotite, Shepard†) containing nodules of corundophilite (Vermiculite, Shepard†) inclosing white and sapphire-blue corundum.

At Litchfield, Conn., it is found in balls of cyanite, constantly associated with talc and diaspore (Shepard†); and at Norwich, Conn., in small crystals of sapphire-blue color, completely surrounded by fibrolite (Shepard†).

In Pennsylvania corundum is found in many localities between the serpentine and the granitic and gneissoid rocks, commencing near the Blue Hill, in Upper Providence Township, and extending for about five miles to near Rockdale, Middletown Township, Delaware County; and again appearing near Unionville, in Newlin Township, Chester County.

At Mineral Hill and the Black Horse, near Media, Delaware County, occurs a feldspathic rock, consisting of a triclinic feldspar of a yellowish-white or white color and granular structure, and showing striation very distinctly on some of the cleavage planes. A great part of it is already changed into kaolinite. It appears to be free from quartz, but disseminated through the mass are crystals of corundum more or less altered into fibrolite and a micaceous mineral, probably damourite; many loose crystals of corundum are found in the soil.

At Unionville, Chester County, crystals of corundum have been frequently met with in the soil, and even large boulders are not of unusual occurrence; a little over one year ago, the bed from which these evidently came was discovered. At the time of my visit I could see a mass of almost solid corundum about thirty feet in length, from five to ten feet in thickness, with a depth of about fifteen feet. The corundum is of a granular structure, a brownish-grey color, and like the crystals which

* J. H. Adams—Sill. Journ. [2] XLIX, 272.

† C. U. Shepard—Sill. Journ. [3] IV, 179-180.

were found in the soil, shows a gradual change into several other minerals. The species which have been observed at this locality are diaspore, gibbsite (Seal*), damourite, margarite, soda-margarite, euphyllite, zoisite, tourmaline, chlorite, lesleyite and pattersonite.

About one mile from Unionville on the road to Kennett Square, corundum crystals are found imbedded in granular albite, together with euphyllite and tourmaline; it is also ascociated with black spinel, chlorite, talc, actinolite, etc.

Of the occurrence of corundum in Virginia, I have only one indication in the shape of a piece of a pebble from the neighborhood of Staunton, Augusta County, which principally consists, as shown by a qualitative analysis, of chloritoid with minute particles of corundum disseminated through it and a mass of damourite attached to, or passing in small seams through the chloritoid.

By far the most numerous localities of corundum, and many of them of great scientific interest, are found in North Carolina. The most Eastern occurrence which appear to belong to this formation, is on the lands of the Widow McChristian near Friendship, in Guilford County, and forms part of the great titaniferous iron ore belt of that State.

The corundum, of which only some surface specimens have been found, is a *true emery*, consisting of granular corundum, mechanically mixed with magnetic iron. It is associated with a chloritic mineral, generally changed into a white micaceous one by weathering, ilmenite and small quantities of chromite. Two samples gave me as follows:

Corundum.....	= 52.24	—	44.86
Magnetite.....	= 42.77	—	46.29
Silicates, etc.....	= 4.99	—	8.85

The whole bed lies in granitic rocks and there is no sign of serpentine or chrysolite in the neighborhood; the presence of chromite, however, and of the chlorites, closely resembling those of the serpentine range, makes it probable that the belt belongs to the latter.

Science is much indebted to Rev. C. D. Smith, to whom the credit is due, for the discovery of the corundum belt which stretches with occasional interruptions in a southwesterly direction from Madison County, North Carolina, through Georgia into Tallapoosa County, Alabama, a distance of at least 250 miles. Of this, C. U. Shepard† gave, a short time ago, an elaborate description. The first large mass was found in 1847, on the French Broad River, three miles below Marshall in Madison (then Buncombe) County. It was of a dark-blue color and was associated with chlorite and margarite. The bed from which this and several smaller masses occurring in loose boulders have come, has never been found; but judging by the associated minerals there can be no doubt that it came from the great chrysolitic belt. I believe that I was the first

* T. F. Seal—Sill. Journ. [2] XI. 267.

† C. U. Shepard—Sill. Journ. [3] IV. 109 to 114 and 175 to 180.

to suggest, that the chromiferous and nickeliferous serpentines and talc slates owe their existence to the decomposition of chrysolite rocks;* an opinion which has since been proved to be correct for those rocks wherever they have been found; and lately by very careful examinations of serpentines and serpentine-like rocks made by Richard von Drasche.†

C. U. Shepard‡ endeavors to show that the real composition of these rocks is not that of chrysolite but of villarsite. I have, therefore, requested Mr. Th. M. Chatard to analyze a specimen from the Culsagee Mine or Corundum Hill, near Franklin, Macon County, North Carolina, and for comparison, add my old analysis of a variety from Webster, Jackson County, North Carolina.

	Chatard.	Genth.
SiO_2	= 41.58	41.89
Al_2O_3	= 0.14	trace
FeO	= 7.49	7.39
NiO (tr Co & Mn)	= 0.34	0.35
MgO	= 49.28	49.13
CaO	= 0.11	0.06
Ignition	= 1.72	0.82
Chromic iron, etc	= ——	0.58
	100.66	100.22

Villarsite is only an intermediate product of decomposition between chrysolite and serpentine. A rock, which approaches the latter mixed with a triclinic feldspar, occurs under similar circumstances as the Cullakenee or Buck Creek Mine in Clay County.

An analysis of a specimen which, however, was not quite pure, gave me:

SiO_2 (by difference)	= 35.19
Al_2O_3	= 0.64
FeO	= 9.70
MgO	= 40.99
Ignition	= 13.48
	100.00

The outcrop of the Culsagee Mine extends over thirty acres and the strata developed there are, according to Prof. Shepard (loc. cit.):

"1. Chrysolite rock, somewhat mixed with anthophyllite;

2. a layer of micaceous rock;

3. a seam of chalcedony;

4. a stratum of chloritic rock (ripidolite);

5. the same through which the corundum is irregularly diffused, sometimes in narrow veins or widening out to several feet."

* F. A. Genth—Sill. Journ. [2] XXXIII, 202.

† R. von Drasche, in G. Tschermak's Mineralogische Mittheilungen 1871, 1.

‡ C. U. Shepard—Sill. Journ. [3] IV, 112.

"Narrow veins containing, besides the chlorite and corundum, a dark-blackish-green spinel, more or less mingled with black tourmaline, traverse the layers 4 and 5 in various directions."

From Col. Jos. Willcox I have obtained some additional information. He states that the chlorite schist is much decomposed even to a depth of fifty or sixty feet, and the corundum in the same easily falls into fragments. The chlorite schist strikes northeast and southwest. At right angles to it a vein of chlorite several feet wide has been uncovered, which contains the large crystals of corundum, which also fall readily into fragments. A small vein of much decomposed albite, containing small crystals of corundum, passes through the chlorite. At the same place small crystals of corundum are occasionally found in black tourmaline. Associated with the minerals already named are actinolite, asbestus talc, etc.

From Prof. Shepard's paper and the private communications of Rev. C. D. Smith and Col. Jos. Willcox, I gather the following information with reference to the Cullakanee or Buck Creek and the Shooting Creek localities, both in Clay County.

About twenty miles southwest from the Culsagee Mine near Buck Creek, in Clay County, is the so-called Cullakenee Mine; the outcrop of the chrysolitic rock covering an area of about 300 acres. Corundum is here found in boulders in many places. The chrysolite contains the usual associates of the serpentine localities, such as actinolite, picrolite, etc., and is already partly changed into serpentine. Near the middle of this chrysolite bed is an outcrop of a very peculiar rock, resembling the omphacite of Hof, Bavaria, and consisting of green smaragdite,* a white triclinic feldspar and highly colored grains of ruby, sometimes also intermixed with small quantities of cyanite and chromite. The corundum at the Cullakenee Mine is generally of a grayish-white, or pale ash-gray color, rarely with specks of sapphire through it; sometimes also of a beautiful pink color, and is associated with andesite, zoisite, margarite, hornblende, and rarely with chlorite, spinel and tourmaline. A peculiar white or grayish-white scaly mineral in flattened masses with a nucleus of corundum rarely occurs, which is described under the name willcoxite.

About ten miles southwest of Cullakenee, near Shooting Creek, Clay County, corundum is again met with, and for five or six miles from this place extending into Towns County, Georgia, it is found at many places associated with chlorite, and probably smaragdite; the chrysolite lying between beds of hornblendic gneiss.

The Rabun County, Georgia, locality much resembles that of the Culsagee Mine near Franklin, North Carolina, and the corundum which I have seen from there can hardly be distinguished from the latter.

Near Gainesville, Hall County, Georgia, occurs a very peculiar variety of corundum. For the information about this locality and the specimens

*See below.

I am indebted to Rev. C. D. Smith. He states that soapstone appears to be the leading rock. Amongst the specimens were several which appeared to be talc slates of a pale greenish-white color, but, which by an analysis of Dr. Geo. A. Koenig, were proved to be a true chlorite slate. He found:

SiO_2	= 30.33
Al_2O_3	= 20.90
Fe_2O_3	= 4.00
FeO	= 4.11
MgO	= 27.79
Ignition	= 12.62
	99.75

The corundum occurs as a nucleus in irregular kidney-shaped masses of margarite, or with a peculiar earthy mineral of a color between isabel and flesh-red, and frequently intersected by veins of a fine scaly or massive margarite. I shall give the analyses of both in the mineralogical part of this paper. There are found at the same locality dark-green foliated chlorite, actinolite, asbestus and tourmaline.

It remains to say a few words with reference to the occurrence of corundum near Dudleyville, Alabama. For specimens from this locality I am indebted to Rev. C. D. Smith, of Franklin, North Carolina, and to Prof. Eugene A. Smith, of Tuscaloosa, Alabama. From these it is evident that the deposit is a repetition of those already discussed; chrysolite rocks to a great extent changed into serpentine and even talc, with asbestus, chlorite and tourmaline; the corundum is associated with spinel, margarite and dudleyite, a mineral resulting from the alteration of the latter.

Very similar to these occurrences of corundum in our great chromiferous serpentine region are those in the Ural, described by G. Rose.* At Mramorsk, on the west side of a marble quarry is one of leekgreen serpentine, and at another quarry a greenish-black chlorite schist with fine grained emery intermixed. The chlorite schist contains little veins or patches filled with a rose-red or reddish-brown mineral, foliated chlorite, a white micaceous mineral and yellowish-gray granular zoisite. Some of the veins contain diaspore and chloritoid. The marble quarry at Kassoibrod has on its western side chloritic schist; on the eastern side granite. In the chlorite schist was found a crystal of blue corundum, a six-sided prism with basal plane on which was observed white star-like opalescence. Generally there is very little corundum present; the associations of which are tourmaline, chlorite, etc.

J. L. Smith,† in his very important paper on emery, relates the occurrences of emery, corundum and associated minerals in Asia Minor and the Grecian Archipelago. According to his observations the emery is

*G. Rose Reise nach dem Ural, etc., 151, 248, 256.

†J. L. Smith--Sill. Journ. [2] X, 355 ff. and XI, 53 ff.

always imbedded in marble or granular limestone when found in situ; the marble lies upon mica slate, gneiss or granite. The minerals associated with the emery and corundum are: diaspore, gibbsite, zinc-spinel, pholerite, ephesite, margarite, mica (muscovite?) chloritoid, black tourmaline, chlorite, magnetite, hematite, limonite, rutile, ilmenite and titaniferous iron.

This represents very much the list of the species which occur with the corundum and emery of our chromiferous serpentine region and it is not improbable that the emery beds in Asia Minor and Greece are of analogous age.

I have now to speak of the occurrence of corundum or of minerals resulting from its alteration in a series of slates considered by E. Emmons* as belonging to his Taconic System.

The first corundum in them was discovered in 1852, by Dr. C. L. Hunter,† in Gaston County; it occurs at Crowder's Mountain and Clubb's Mountain; and it has lately been discovered under similar circumstances in Rutherford County. It is associated with rutile, cyanite, damourite, lazulite, pyrophyllite, gold and quartz.

There are reasons to believe that the pyrophyllite beds in Orange, Chatham, Moore and Montgomery Counties are analogous to the corundiferous strata of Gaston County; and the same appears to be true for those at Graves Mountain, Lincoln County, Georgia.

There are two occurrences of conundrum in cyanite in the gneissoic rocks at Swannanoa Gap, Buncombe County, and in Wilkes County, North Carolina; neither of which seem to have any connection with the serpentine belt.

I have yet to mention the occurrence of corundum in Laurens District, South Carolina, which is probably in mica slates. All the specimens which I have seen from this locality are rough bipyramidal crystals from one to three inches in length and from one-fourth to one inch in thickness. They are all more or less altered. Most of them are coated with a micaceous mineral into which many of the crystals are completely converted.

I shall not dwell upon the crystals of corundum, ruby and sapphire which are frequently met with in the heavy sands of gold washings as they occur in too minute quantities to have any bearing upon the principal questions which forms the subject of this investigation.

After thus giving a brief outline of the geological features of the occurrence of corundum, I shall now enter upon the consideration of the minerals which are fonnd in association with the same, but will first make a few remarks with reference to the chemical analyses which are embraced in this paper.

The greatest pains were taken to select the very best and purest material; and all the small fragments, before being reduced to powder, were

* Ebenezer Emmons, Geol. Report of the Midland Counties of North Carolina, 1856.

† C. L. Hunter—Sill. Journ. [2] XV, 373.

repeatedly examined with a powerful magnifying glass, until the material for analysis was as clean as it was possible to obtain it. This plan was always strictly adhered to, except in a few cases where it was an impossibility to obtain perfectly pure material, but where an approximation was still desirable to identify the species.

The finely powdered minerals were then dried under an exsiccator, over sulphuric acid. As very few of the species analyzed could be decomposed by acids, they had to be fused with sodic carbonate to render them soluble. For the alcalies, the mineral was in a few cases decomposed by fluohydric acid, generally, however, by J. L. Smith's very accurate and convenient method.

The mass of the sodium fusion was then *completely* disintegrated by water, and the whole dissolved in very dilute chlorhydric acid. If the decomposition of the silicates was *complete* and *no appreciable quantity of corundum was mechanically mixed with the mineral*, the solution in dilute acid was perfect, and rarely only a few flakes of silicic acid separated, which were easily distinguished from the heavy, hard, sandy corundum. Both (if both were present) were filtered, washed, dried, ignited and weighed; the silicic acid extracted by a dilute solution of potassic hydrate. After washing out with boiling water, to which towards the end of the washing, a few drops of chlorhydric acid was added, the corundum was weighed, then rendered soluble by fusion with potassic hydric sulphate, from the solution of which the pure alumina was precipitated as usual.

From the fusion for the alcali determination, the residue after extraction by boiling water was treated in a similar manner. The fusion with sodic carbonate acts more powerfully upon corundum, but unfortunately even the fusion of corundum with calcic carbonate and ammonic chloride, renders such a quantity of corundum soluble, that this method can not be used for a quantitative determination of the same.

The analyses were then conducted as usual, the alumina was separated together with ferric oxide by ammonic hydrate and boiling of the ammonical magma, until it had a neutral or even acid reaction. After filtering and washing they were re-dissolved and re-precipitated, and this operation generally repeated three or four times. The ferric oxide in the alumina was determined after the conversion of both into sulphates and its reduction by zinc, by titration with potassic permanganate.

The amount of ferrous oxide was *always* ascertained by dissolving the minerals in a sealed tube under pressure with dilute sulphuric acid, and subsequent determination with potassic permanganate.

Some apparently quite pure spinels left when treated in this manner a small quantity of a sandy powder, which proved to be corundum. I had hoped that by this method an accurate determination of corundum, mechanically mixed with other minerals, could be obtained, but I found that dilute sulphuric acid under such circumstances dissolves corundum,

reduced to an impalpable powder, with tolerable ease. We have therefore no means to determine the quantity of corundum, which is *mechanically* mixed with another mineral. This is unfortunate, as it will leave us in doubt about the true constitution of some varieties of lesleyite and of ephesite.

Magnesia was always precipitated by ammoniac phosphate. Of the alcalies the potassic sodic and lithic chlorides were weighed together, then the potassium were separated and weighed as potassic platinochloride, and in the filtrate, after the removal of the excess of the platinum and the conversion of the alcalies into sulphates, the quantities of sodium and lithium were determined by indirect analysis. As however, in many cases the quantity of lithia, indicated by the spectroscope, was only small, very few such determinations have been made.

These being the more important points with reference to the modes of analysis, I shall now proceed with the description of the minerals.

1. Corundum.

As it would require unnecessary repetition, I shall not at present describe the numerous varities of corundum, but shall mention their peculiarities, when treating of the minerals associated with them, and of their relation to each other.

2. Spinel.

Corundum altered into spinel occurs at several localities.

a. The most interesting variety comes from Hindostan, and was found in a lot of corundum crystals, purchased by Messrs. S. S. White & Co., to whom I am indebted for specimens.

The surface of these crystals or crystalline masses is rough, and to many of them reddish orthoclase and a dark mica are attached, showing their matrix to have been granite. Some pieces of the corundum contain also small scales of reddish-white margarite. The crystals are too indistinct for measurement, but the basal plane and one or two pyramids can be observed. Many are completely altered, most of them, however, show that the alteration began at the surface and has irregularly penetrated the crystals towards the centre, often leaving a nucleus of brownish-gray cleavable corundum, or patches of the same irregularly distributed through the mass. Most of the crystals are from a half an inch to about two inches in size, rarely larger.

The spinel, which is the result of this alteration, has a black color, granular crystalline structure and a submetallic to vitreous lustre. Its powder is gray ; it is slightly magnetic.—H.=8. Sp. Gr.=4.208.

b. In the shaft on the road from Unionville to Kennett Square, associated with granular grayish-white talc and greenish actinolite occurs intimately mixed with chlorite, a black granular mineral of vitreous lustre and a hardness superior to that of quartz. It was impossible to obtain it for analysis in a state of purity, but sufficiently so to prove it to be spinel.

c. The vein of spinel passing through the chlorite at the Culsagee Mine,

North Carolina, has already been noticed above. The spinel is generally massive, coarsely to finely granular; also met with in octahedral crystals with dodecahedral planes; the latter often indicated only by striation. The crystals are often imperfect and cavernous, and mostly altered on the surface, being covered with a varnish-like coating of a brownish-gray mineral of vitreous lustre. The interior of the crystals like the fresh fracture of the unaltered massive spinel is black. The spinel contains, sometimes, grains of a reddish-brown rutile, and is always more or less intermixed with grains of corundum and chlorite, the latter frequently radiating from it. One specimen in the University collection is a mass of chlorite, radiating from nucleus consisting of a mixture of spinel and corundum.

d. Another variety of spinel from the same locality, of which, however, I found only a single specimen, resembles G. Rose's *chlorospinel* from Slatoust, and is found in deep leek-green or greenish-black octahedra with deeply striated dodecahedral planes or in granular masses of the same color; it is associated with a pale green foliated chlorite and white corundum. The spinel is often imbedded in the foliæ of the chlorite and not unfrequently contains particles of corundum in its centre. Its pow der is pale grayish-green.

e. The collection of Col. Jos. Willcox contains a specimen from the same locality which evidently was once a corundum crystal. It measures about two and a-half inches in diameter and its outlines indicate its origin. It now consists of a nucleus of black spinel with a mantle of chlorite.

f. At the Cullakenee Mine spinel is of rare occurrence. I have seen only one piece in which a black variety in grains and octahedral crystals is disseminated through dark green foliated chlorite.

g. At Dudleyville, Tallapoosa County, Alabama, black spinel surrounding patches of yellowish-white cleavable corundum occurs in chlorite.

h. In connection with these observations it is worthy of notice that a variety of spinel, gahnite, in association with the corundum of Gumuch-Dagh in Asia Minor was discovered by J. L. Smith (loc. cit.).

The following analyses were made:

*a*1 and 2, from Hindostan, by myself.
b, from Unionville, by Dr. G. A. Koenig.
*c*1, fine-grained from Culsagee, by Dr. Koenig.
*c*2, coarser grained from Culsagee, by Dr. Koenig.
d, coarse-grained and crystallized dark-green from Culsagee, by myself

	*a*1	*a*2	Mean.	*b*	*c*1	*c*2	*d*
Sp. Gr.	= 4.208	——	——	——	3.766	3.797	3.695
Al_2O_3	48.87	48.10	48.49	54.61	60.03	62.38	68.08
Fe_2O_3	17.30	18.17	17.73	4.10	9.49	7.79	1.75
Cr_2O_3	——	——	——	——	3.23	1.81	trace.
FeO	23.53	23.25	23.39	10.67	9.33	11.89	11.02
MnO	trace.	trace.	——	——	——	——	trace.
MgO	6.86	6.66	6.76	13.83	16.74	14.98	19.29
SiO_2	——	——	——	1.26	1.14	1.56	CuO = 0.11
Corundum	=4.31	4.31	4.31	16.24	——	——	NiO = 0.24
	100.87	100.49	100.68	100.71	99.96	100.41	100.49

Neither specimen showed on examination with a magnifying glass any corundum, but both *b* and *c*1 and 2 contained small quantities of chlorite. I shall leave out the analysis *b*, which was made with material of not sufficient purity to base any calculation upon the results, but only for the purpose of ascertaining the character of the black mineral. This analysis, however, established the very important fact of the mechanical admixture of corundum. Taking into consideration the analyses of *a* and *c*1 and 2, and *d*, we arrive at the following data:

a. The oxygen in the mean results of the two analyses of the spinel from Hindostan is, in the sesquioxides, 4.22 per cent. in excess over that required by the formula RO,R_2O_3, showing that besides the 4.31 per cent. of corundum, which was not dissolved by dilute sulphuric acid, 9.05 per cent. had gone into solution, and that the most carefully selected material still contained a mechanical admixture of 13.36 per cent. of corundum. The composition of the pure spinel, together with that of the pure spinels from Culsagee, I shall give below.

*c*1. After deducting for 1.14 per cent. of SiO_2, 0.93 Al_2O_3, 0.09 Fe_2O_3, 0.22 FeO and 1.18 MgO, corresponding with the foliated chlorite from this locality, the oxygen ratio between RO and R_2O_3 required by the spinel formula is 6.67 per cent. in excess in the sesquioxides, representing an admixture of 14.74 per cent. of corundum.

*c*2. The 1.56 per cent. of SiO_2 require, for making the foliated chlorite associated with the spinel, 1.28 Al_2O_3 0.14 Fe_2O_3, 0.32 FeO and 1.61 MgO, which being deducted, leaves the oxygen ratio between RO and R_2O_3 = 7.92 : 31.34, being for the sesquioxides 7.58 per cent. more than that required by RO, R_2O_3; this corresponds with a mechanical admixture of 16.27 per cent. of corundum.

d. The decomposition by dilute sulphuric acid gave 0.73 per cent. of silica and a trace of corundum, which were deducted from the quantity taken for analysis. The oxygen ratio 1 : 3.15 is nearly that of spinel. The excess of 1.57 per cent. of oxygen would represent an admixture of 3.37 per cent. of corundum.

After deducting these mechanical admixtures, the composition of the pure minerals is represented by the following:

	Hindostan *a*.	Culsagee *c*1.	Culsagee *c*2.	Culsagee *d*.
Al_2O_3 =	45.17	54.32	56.58	66.63
Cr_2O_3	—	3.96	2.28	trace.
Fe_2O_3	20.30	11.51	9.66	1.80
FeO	26.79	11.16	14.60	11.35
MgO	7.74	19.05	16.88	19.86
CuO	—	—	—	0.11
NiO	—	—	—	0.25

These analyses show that the spinel, pseudomorphous after corundum, from Hindostan, and the green spinel from Culsagee *d*, are mixtures of the spinel varieties *pleonaste* and *hercynite*, whilst the spinels from Culsagee *c* (1 and *b*) contain besides an admixture of the variety *picotite*.

The spinels from Unionville, Pennsylvania, and Dudleyville, Alabama, contain only traces of chromic oxide and are probably mixtures of pleonaste and hercynite.

3. Diaspore.

Diaspore has been observed in many places as the result of the hydration of corundum, but I am not aware that ever a real pseudomorph has been met with.

J. L. Smith (loc. cit.) has made the very important observation that all the corundum, which he had examined, contained water in variable quantities from 0.68 to 3.74 per cent., but states that the more careful and repeated examination showed the absence of diaspore or any other hydrate of alumina. May it not be that the diaspore is so very minutely distributed through the corundum, that even the best microscopic, or other examination could not detect it, as I just have shown with regard to the admixture of corundum in spinel?—On page 58 he makes the following remark: "*Yet of all the specimens collected, none offer so "much interest as those of diaspore imbedded in the corundum; here we "see the two minerals, without being able, in many places to distinguish the "line of separation, so imperceptible is the gradation. After what has "been said in respect to corundum, it is not astonishing to see this con- "nection of alumina more or less hydrated, with a hydrate of alumina of "definite composition.*"

The diaspore from the different localities has been so fully described that I have but little to add.

With the exception of the locality of Chester, Mass., where it had been found in considerable quantity and of great beauty, diaspore is a rare mineral in this country. Most beautiful crystals of it were found at the Unionville, Pa. locality, by Dr. Isaac Lea,* who gave a description of them before the Academy of Natural Science.

J. C. Trautwine† first noticed this mineral in cavities of the massive corundum from the Culsagee Mine, North Carolina, where it occurs in very minute but beautiful acicular crystals of the usual forms. Only one or two specimens have thus far been discovered.

I have not been able to detect it at any other of the North Carolina, South Carolina, Georgia or Alabama corundum localities.

4. Beauxite.

This hydrate of alumina, generally mixed with a considerable quantity of ferric hydrate and a hydrous aluminous silicate, occurs in considerable quantities in the southern part of France; it incloses occasionally grains of corundum.

T. S. Hunt's‡ remarks about this interesting fact, are as follows: "By intense heat this substance (beauxite) *is converted into crystalline*

*Proceedings of the Academy Natural Sciences, April 9, 1837.

†Journ. Franklin Institute, XCIV. 7.

‡T. S. Hunt, Sill. Journ. [2] xxxii. 288.

"*corundum resembling emery in its physical characters, but the presence of grains of corundum in the hydrated mineral seems to show that the trans-*
"*formation may take place at ordinary temperature.*" I do not know of a single instance, in which corundum could have been eliminated under such circumstances from the hydrate; on the contrary, the presence of grains of corundum in the beauxite prove pretty conclusively, that the latter results from the hydration of corundum, and that the grains which have been found are remnants not yet converted. The same may be said of the inclosing argillaceous matter, that it is the result of the alteration of corundum.

5. Gibbsite.

This very rare hydrate of alumina has been so far as I can discover, only twice noticed in contact with corundum, evidently resulting from its hydration, first at Gumuch Dagh, Asia Minor, by J. L. Smith (loc. cit.) who observed it as forming an external coating of a crystal of corundum, and also in the form of a hexagonal prism. The latter is very probably a pseudomorph of gibbsite after corundum. The second locality is at Unionville, Pa., where T. F. Seal* found it as a thin coating of small mamillary incrustations on the albite rock. (The other coatings on corundum crystals, of which he speaks, are evidently not gibbsite, but margarite, as I shall show in the sequel.)

6. Quartz.

Sillem† mentions that quartz occurs pseudomorphous after corundum. I have never observed this pseudomorph, and have not seen the original paper, I therefore merely mention the fact for the sake of completeness.

7. Opal.

It is perhaps worthy of notice that I have observed the variety hyalite in connection with corundum and minerals resulting from its alteration. At the Culsagee Mine it is rarely found in beautiful colorless and white botryoidal incrustation upon foliated chlorite, and also upon corundum. From Dudleyville, Alabama, I have one specimen, on which it occurs as a brownish-white botryoidal incrustation upon blue cleavable corundum.

One of the pseudomorphous fibrolite crystals, from Mineral Hill, Delaware County, Pa., has a slight coating of an amorphous botryoidal vitreous mineral, which appears to be hyalite.

8. Smaragdite (?) (Kokscharoffite).

I have already mentioned the peculiar rock formed by Smaragdite (?), a feldspathic mineral, and grains of pink or even deep ruby corundum, and sometimes chromite disseminated through the mass, which occurs at the Cullakenee Mine.

The grains of smaragdite (?) are very indistinct in form, but frequently show an obtuse angle like that of an amphibole. The color is from

*T. F. Seal. Sill. Journ. [2] xl, 267.
†Sillem, Leonhard & Bronn's Jahrbuch—1851, 385.

emerald to grass-green, and passing into grayish-green to greenish-gray. H — 5.5. Sp. Gr. of the grass-green variety — 3.120.

B. B. it melts easily to a greenish glass, whilst the outer flame is colored yellow.

A sample of the grass-green mineral, selected with great care and apparently *free from feldspar*, was analyzed by Mr. Thos. M. Chatard, who found:

SiO_2	=	45.14	contains oxygen	24.07		=2.06
Al_2O_3	=	17.59	" "	8.20	= 8.45	=0.72
Cr_2O_3	=	0.79	" "	0.25		
FeO	=	3.45	" "	0.77	= 11.7	= 1
NiO	=	0.21	" "	0.04		
MgO	=	16.69	" "	6.68		
CaO	=	12.51	" "	3.57		
Na_2O	=	2.25	" "	0.58		
K_2O	=	0.36	" "	0.06		
Ignition	=	1.34				
		100.33				

This gives very nearly the atomic ratio of RO* : R_2O_3 : SiO_2 = 1 : 0.25 : 1 = 4 : 1 : 4, corresponding to the formula : 4RO, $3SiO_2$ + R_2O_3, SiO_2.

It will be observed that this agrees exactly with the composition of Kokscharoffite, and that it has no resemblence to arfvedsonite, with which it has been placed by C. U. Shepard (loc. cit.) as chromarfvedsonite. At some corundum localities we find that other varieties of amphibole are associated with corundum, or even penetrate into the mass of the same.

A black or brownish-black hornblende frequently occurs in the andesite of Cullakenee, Clay County, North Carolina, and a dark green almost black variety, resembling actinolite is found, often associated with zoisite, with and in the corundum of the same locality; also with the corundum at Shooting Creek in the same County, and rarely at the Culsagee Mine.

9. Zoisite.

In the Ural, at Mramorsk, zoisite has been observed by G. Rose (loc. cit.) as an associate of corundum. B. Silliman† described it under the name *unionite* as occurring in company with corundum, tourmaline and euphyllite at Unionville, Pennsylvania, but the best locality of it is the Cullakenee Mine, in Clay County, North Carolina. Here it occurs in crystals, but usually in compact columnar and easily cleavable masses. Its color is from grayish to greenish and brownish-white. Many of the specimens show distinctly that it is the result of the alteration of corundum. The pink corundum is often surrounded by a thin coating of

*Including R_2O in this and all subsequent analyses.

†B. Silliman 2] VIII, 384.

white zoisite. The University collection contains some remarkable specimens.

One forms a narrow vein of cleavable pink corundum in grayish-green hornblende. Between the corundum and the hornblende is a thin lining of zoisite, which becomes thicker and thicker and soon occupies the whole vein, first in compact, then in cleavable columnar masses, the corundum having entirely disappeared. Another piece of blueish-gray corundum is on one side altered into columnar brownish-white and white zoisite, whilst the interior is to a great extent changed into margarite. Many of the other pieces show nuclei of unaltered corundum disseminated through the mass of zoisite.

The following were analyzed:

a, slightly greenish-white cleavable zoisite, the result of the alteration of pink corundum, by Dr. Koenig.

b, white, slightly grayish columnar zoisite, resulting from blueish-gray corundum, nuclei of which were still visible, by myself.

c, for comparison I give the analysis of the zoisite from Unionville, by G. J. Brush* (Silliman's Unionite).

		a.	*b*1.	*b*2.	*c.*
Sp. Gr.	—	3.286		3.224	3.299
SiO_2	—	40.70	39.43	39.86	40.61
Al_2O_3	—	33.86	34.92	33.84	33.44
Fe_2O_3	—	0.81		1.62	0.49
MnO	—	trace.		trace.	——
MgO	—	0.22		0.18	trace.
CaO	—	24.05		23.82	24.13
Na_2O (trace Li_2O)	—	not det'd		0.22	——
K_2O	—	.. ..		0.09	——
Ignition	—	0.63		0.78	2.22
		100.27		100.41	100.89

The oxygen ratio of RO : R_2O_3 : SiO_2 are as follows:

a	—	6.96	: 16.02	: 21.71	—	1	: 2.30	: 3.12
b	—	6.94	: 16.25	: 21.26	—	1	: 2.34	: 3.06
c	—	6.89	: 15.74	: 21.66	—	1	: 2.28	: 3.14

All these analyses of the zoisite associated with corundum show a slight excess of alumina, if we take the ratio of 1 : 2 : 3 as representing the composition of zoisite. If this is owing to a small admixture of unaltered corundum, the three specimens analyzed would contain: *a* 4.50 per cent., *b* 5.0 per cent., and *c* 4.21 per cent. of it.

10. Feldspars.

Many varieties of feldspar occur with corundum under circumstances which are of the greatest scientific interest.

a. A white, grayish and reddish variety of *anorthite* called *indianite*

* G. J. Brush, Sill. Jour. [2] XXVI, 69.

by Count Bournon, is the matrix of corundum in the Carnatic. Associated minerals are cyanite and garnet. It has been analyzed already by Chenevix more than 70 years ago, and lately again by G. J. Brush* with almost identical results, if we except the small quantity of soda which the former had overlooked. Oxygen ratio of RO† : Al_2O_3 : SiO_2 — 1 : 3 : 4.

b. A snow-white massive granular feldspar also occurs as the matrix of corundum at Barsowskoi, near Kyschtimsk in the Ural, where G. Rose discovered it, who finding it different in composition gave it the name of *barsowite*. Oxygen ratio of CaO : Al_2O_3 : SiO_2 — 1 : 3 : 5. I have seen only one specimen in which the grayish corundum in dipyramidal crystals was disseminated through the feldspathic mineral. In fracturing a piece the corundum crystals left a smooth impression upon the barsowite, as if they were already hard when the latter was still in a plastic condition.

c. A snow-white or blueish-white cleavable variety of feldspar showing a fine striation upon the cleavage planes, is found associated with a greenish-black hornblende with a distinct cleavage angle of 124°, is found at the Cullakenee corundum locality, but I have not been able to detect corundum in any of the *cleavable* specimens, which I had for examination. See analysis below. (a).

A granular and very compact variety with crystals of corundum disseminated through it, is found at the same locality. In a fresh fracture the corundum is hardly distinguishable, except by its somewhat grayer color. In weathered specimens the corundum crystals, some of nearly one inch in diameter, stand out in bold relief. They are very rough, as if they were eaten, and in many of them a micaceous mineral, damourite probably, is associated with them, which not only coats the outside but penetrates even to the centre of the crystals. I received this variety too late for chemical analysis.

Together with massive gray corundum, partly altered into zoisite, is rarely found at the same locality a white granular variety of feldspar, much of the appearance of sugar, but pretty tough. It seems to have been the result of the alteration of corundum. The analysis is given below (b).

d. Another fine-grained and very friable variety from Cullakenee has much of the appearance of the oligoclase (indianite) of Chester, Massachusetts. It is distinguished from the Chester mineral by a dissemination through the whole mass of fine grains or crystals of hornblende, whilst the latter contains biotite in their place. It has not been analyzed.

I have already mentioned the triclinic feldspar, forming with smaragdite and red corundum, the peculiar rock which so nearly resembles that from Hof in Bavaria. I have not been able to obtain it in a state of sufficient purity for analysis.

* Dana's Descriptive Mineralogy. 1868, 339.

† RO = 1·6 Na_2O + 5·6 CaO.

From this locality I have the analyses of the cleavable snow-white variety (*a*) by Dr. Koenig; and of the fine-grained, like sugar, probably resulting from the alteration of corundum, by Mr. Thos. M. Chatard (*b*) They found:

		a.			*b.*		
Sp. Gr.	—	2.611	oxygen		2.610	oxygen	
SiO_2	—	57.29	30.55		58.41	31.15	
Al_2O_3	—	26.52	12.36	12.42	25.93	12.08	12.19
Fe_2O_3	—	0.21	0.06		0.38	0.11	
MgO	—	0.15	0.06		0.18	0.07	
CaO	—	7.80	2.23	4.09	5.82	1.66	3.74
Na_2O	—	6.75	1.74		6.45	1.66	
K_2O	—	0.33	0.06		2.10	0.35	
Ignition	—	1.43			0.93		
		100.48			100.20		

The oxygen ratios in the two analyses are as follows:

RO : R_2O_3 : SiO_2 in *a* — 4.09 : 12.42 : 30.55 — 0.99 : 3 : 7.51
in *b* — 3.74 : 12.19 : 31.15 — 0.93 : 3 : 7.67

which is near the atomic ratio of 1 : 1 : 4, agreeing with the formula of andesite — $(Na_2O, CaO)\ SiO_2 + Al_2O_3, 3SiO_2$.

e. The soda-oligoclase, which, associated with euphyllite, accompanies corundum at Unionville, Pennsylvania, has been analyzed by Smith and Brush*.

A specimen in the University collection from the same locality consists of a granular yellowish or brownish-white oligoclase, the small cleavage planes of which are sometimes finely striated. It has patches of a granular gray corundum disseminated through the mass, mixed with minute grains of a hard greenish-black mineral, probably spinel. The corundum in some places altered into a soft crypto-crystalline slightly pearly, white or grayish-white mineral, which appears to be margarite; it is frequently penetrated by the oligoclase and looks as if it was a remnant from its conversion into oligoclase and other species. The analysis of it by Mr. Chatard gave:

SiO_2	=	59.35	contains oxygen	31.65	
Al_2O_3	=	24.16		11.26	= 11.44
Fe_2O_3	=	0.61		0.18	
MgO	=	0.34		0.14	
CaO	=	3.08		0.88	= 3.52
Na_2O	=	7.22		1.86	
K_2O	=	3.78		0.64	
Ignition	=	1.96			
		100.50			

The oxygen ratio of RO : R_2O_3 : SiO_2 = 3.52 : 11.44 : 31.65

* Sill. Journ. [2] XV, 211 and XVI, 44.

which is = 0.92 : 3 : 8.30, or very near 1 : 3 : 9 in accordance with the formula of oligoclase = 2 (K_2O, Na_2O, CaO), 3 SiO_2 + 2 (Al_2O_3, 3 SiO_2).

f. The yellowish-white granular feldspar of Mineral Hill, Delaware County, Pennsylvania, above referred to, which contains crystals of corundum altered into fibrolite and other minerals, seems also to be oligoclase.

g. The so-called indianite from Chester, Massachusetts, has been proved by C. T. Jackson's* analysis to be granular oligoclase.

h. The white granular feldspar from the locality on the road from Unionville to Kennett Square has been analyzed by Brush and Weld,† who found it to be albite, containing a small percentage of lime. It is frequently the matrix of gray corundum associated with euphyllite (?). The corundum crystals are rough and irregular and are always more or less coated, enveloped or changed into euphyllite, and also a soft, apparently amorphous, mineral, which is probably a variety of margarite, of which, however, I had not enough for an analysis.

The very interesting question presents itself: are the feldspars found in connection with the corundum, the result of the alteration of the latter? I am not prepared to give a positive answer, and believe that it requires a great many more observations before it can be decided. From what I have seen, it appears that there are cases where feldspars have been formed from corundum, and it is very probable that many have thus been formed, but that at the same time a portion of the alumina re-crystallized as corundum, which we then find imbedded in the feldspathic matrix.

Very similar occurrences must have taken place in several other instances, to which I will here refer, viz.; the crystals of corundum in a matrix of tourmaline and the beautiful, very well defined crystals of it in the chlorite of the Culsagee Mine.

11. Tourmaline.

Tourmaline has been found in association with corundum at most of the localities already referred to; for example, at Kassoibrod in the Ural, at Naxos in Greece, at Chester, Massachusetts, at Unionville, Pennsylvania, at the Culsagee Mine, rarely at the Cullakenee Mine, and more frequently at Dudleyville, Alabama.

a. At Unionville black tourmaline is frequently found in irregular masses of different sizes, from a small grain to several inches in diameter, in the corundum as well as in the minerals resulting from its alteration, especially in the foliated margarite or with zoisite and euphyllite. It sometimes shows crystalline prismatic planes, but is mostly granular and occupies the interstices between the corundum itself.

A far more interesting occurrence is mentioned by Dr. Isaac Lea (loc.

* C. T. Jackson's, Sill. Journ. [2] XLII, 107.

† Brush and Weld, Sill. Journ. [2] VIII, 390.

cit.) of a crystal of transparent green tourmaline passing through the middle of a prism of diaspore, and the whole enveloped by lamellar crystals of pearly emerylite (damourite, Gth.). Very similar is the occurrence of slender green crystals in the pseudo-fibrous damourite. These tourmalines are in all probability the result of the alteration of corundum. or, the black tourmaline went into solution and re-crystallized in the diaspore and damourite in a similar manner, as apophyllite dissolved in water in a sealed tube under pressure, crystallizes out on cooling, as shown by Wöhler in his well known and important experiment.

b. The association of corundum with tourmaline at the Culsagee Mine deserves the greatest attention.

There are masses of black tourmaline, which contain more or less frequently, and irregularly disseminated through them, crystals of white and yellowish-white corundum ; plates of chlorite are also, sometimes, penetrating the tourmaline. The corundum crystals have particles of tourmaline intermixed with them, and *vice versa*. *On the whole*, however, the tourmaline looks more like the *matrix* of the corundum. Sometimes there seems to be an almost imperceptible change of granular corundum into tourmaline. Of the numerous specimens which I have examined, two deserve a fuller description. The first is a small piece of black columnar tourmaline, with a micaceous mineral, probably margarite, and grayish-white corundum. In one case the upper part of the columnar mass of tourmaline is occupied by corundum, which also penetrates into a portion of the tourmaline ; the tourmaline frequently contains nuclei of corundum. The second specimen, also from the same mine, for which I am indebted to the kindness of Col. C. W. Jenks, is a pseudomorph of tourmaline after corundum. It is part of a crystal of reddish-gray corundum of a little over two inches in height and about two inches in thickness. It shows three planes of the hexagonal prism and portions of one pyramidal plane. At the upper part of this crystal, almost the entire corundum has been altered into black tourmaline, leaving only a shell of corundum of about one-eighth to one-quarter inch ; at its lower part the corundum, although intermixed with tourmaline, is still about one inch in thickness. Plates of green chlorite penetrate both the corundum and the tourmaline.

c. At the Cullakenee Mine tourmaline occurs but sparingly. It is associated with foliated pink margarite and another mineral in slender prismatic, longitudinally striated crystals, resembling some varieties of epidote, but in too small quantity for mineralogical determination.

d. The occurrence of tourmaline at Bell's Creek, Town's County, Georgia, and Dudleyville, Tallapoosa County, Alabama, presents nothing remarkable.

12. Fibrolite.

For a long time fibrolite has been known to accompany the corundum in the Carnatic, in India, and in the neighborhood of Canton, in China ; the variety much used by the Celts in the *stone age* has been obtained

amongst other localities from the vicinity of Chavagnac and Ourouze, in France, where it is associated with *mica, cyanite, red* and *blue corundum.* One of the most interesting localities is at the Falls of the Yantic, near Norwich,* Connecticut, where the *small crystals* of sapphire are completely surrounded by fibrolite. This is evidently owing to an alteration of corundum into fibrolite.

At Mineral Hill, Delaware County, Pennsylvania, as I have already mentioned above, corundum, more or less completely altered into fibrolite, occurs in a feldspathic rock. The corundum crystals are generally rough, six-sided prisms, tapering at both ends, from one-half to one and a-half inches in length and from one-eighth to one inch in thickness. They are of various shades between white and brown, often of a rich glove-brown color, many exhibiting a white or colorless star of six rays. This star when magnified shows already a fibrous structure. Where the alteration of corundum has just commenced, a thin coating of a grayish-white color, sometimes not thicker than a varnish, can be observed on the brown corundum. Under a strong glass it is seen to consist of a vitreous mineral, which is fibrous and radiating from the corundum. Many of the crystals have still a core of unaltered corundum, in others every trace of it has disappeared, and fibrolite pseudomorphous after corundum is left, the interior of which is made up of congeries of acicular crystals.

Only with great difficulty I was able to select a sufficient quantity of pure material for analyses.

The following are the results :

Spec. Grav. = 3.286.

		a.	b.		c.	Oxygen.	
		Almost Pure.			Purest.		
SiO_2	=	37.76	37.62		37.37	19.93	
Al_2O_3	=	60.27	60.91		60.52†	28.20	28.47
Fe_2O_3	=	0.98	0.94		0.90	0.27	
MnO	=	0.10		0.24	0.10		
MgO	=	0.18			0.25		
CaO	=	0.44	0.40		0.38		
Ignition	=	0.73	0.62		0.48		
		100.46	100.73		100.00		

The oxygen ratio of $R_2O_3 : SiO_2 = 1.43 : 1 = 3 : 2$, agreeing with the formula Al_2O_3, SiO_2.

At several localities in the immediate neighborhood and frequently within the serpentine region, in the State of Delaware, and Delaware County, Pennsylvania, fibrolite is found, which partly at least seems to have been derived from the alteration of corundum. I wish to call par-

* C. U. Shepard, Sill. Journ. [3] IV, 180.

† By difference.

ticular attention to that which occurs between Media, Delaware County, Pennsylvania, and the Asylum for Feeble-Minded Persons. On a fresh fracture, the silky lustre of its fibres can be easily perceived, but it has a slaty structure and is associated with white and pale blueish crystals of cyanite and brown staurolite crystals, many of them in twins. The whole reminds one immediately of the well known staurolite and cyanite crystals in the paragonite slate of St. Gothard.

A similar fibrolite slate is found near the Culsagee Mine, Macon County, North Carolina.

Amongst fifty crystals of corundum from Laurens District, South Carolina, part of which are converted into damourite, I found one broken crystal, the outside of which is changed into fibrolite. It is an irregular six-sided prism, $\frac{5}{8}$ of an inch long, not quite half an inch thick, with a core of unaltered brownish corundum $\frac{1}{4}$ of an inch in diameter. The fibrolite is radiating from the surface towards the core, and the surface is covered with crystalline aggregates of fibrous fibrolite and a few small plates of damourite.

For a highly interesting specimen, I am indebted to John C. Trautwine, Esq. He found it many years ago at Germantown, Pennsylvania. It consists of granular quartz with streaks of grayish-white fibrous fibrolite through it from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch in width, but less than a line in thickness. The centre of several of these streaks is occupied by blue bladed cyanite. It is impossible to decide, whether this is a case of paramorphism, in which the monoclinic changes into the triclinic silicate of alumina, Al_2O_3, SiO_2, or whether both crystallized from the same medium in their present form.

13. Cyanite.

Cyanite is a very usual associate of corundum. It is found with it on the St. Gothard, near Petschau in Bohemia, and in several other foreign localities. It is one of the most important results of its alteration. I have dwelled at fuller length upon the change of corundum into fibrolite, because there we have *real pseudomorphs* which appear not to exist with, chemically, the same aluminous silicate, the bladed structure of the cyanite immediately obliterating, probably, every trace of the original form. However, I shall describe a number of specimens of cyanite, containing still a nucleus of the original mineral, from which they resulted.

a. At Litchfield and Washington, Connecticut, rolled masses of cyanite have been found, which contained corundum and diaspore. I am indebted to Prof. Geo. J. Brush, for a very beautiful and instructive specimen from Newton, Connecticut. It consists of irregularly arranged bladed masses of gray and blueish-white and blue color. In some places, and especially, where the blades meet, a white or yellowish-white micaceous mineral is intermixed; imbedded in it sometimes is diaspore, and in one place in immediate contact with the cyanite, is a rounded fragment of a slightly pink colored corundum.

b. Another superb specimen was presented to me by Col. Jos. Willcox, who collected it a short time ago at Swannanoa Gap, Buncombe County, North Carolina. It consists of a fragment of an irregular hexagonal prism of corundum of about two inches in length and one inch in thickness, of a deep blue and white color, and showing the perfect rhombohedral cleavage; it is surrounded by pale blueish-white cyanite and damourite. The surface of the corundum appears much eaten and the specimen is a beautiful illustration of the alteration of corundum into the two other minerals.

c. A third specimen I received about two years ago from Mr. Hanna, Assistant Assayer of the Mint in Charlotte, North Carolina. It comes from Wilkes County, North Carolina. At that time I had no idea of the importance, in a scientific point of view, of some insignificant particles of corundum in cyanite, and procured the specimens only on account of the beauty of the latter. Mr. Hanna had another piece, which, if my memory serves me right, contains a mass of corundum of about one inch in diameter. The cyanite has an impure blueish-greenish color and coarsely bladed columlar crystals and crystalline masses, some of the blades 1 to 1½ inches across. Several small fragments and grains of corundum, of a gray to a reddish-brown color are visible in the mass of cyanite, one of them showing the usual striation very distinctly. A minute quantity of damourite is also present.

I shall now enter into the discussion of some points with reference to the occurrence of corundum in Gaston and Rutherford Counties, North Carolina, which form a close connection with the remarks just made, although I may be compelled to anticipate some facts, which should not yet be discussed.

At Crowder's Mountain, and Clubb's Mountain, in Gaston County, and at a recently discovered locality in Rutherford County, North Carolina, corundum is found massive and in crystalline pieces, sometimes showing a hexagonal form; its color is from deep blue to purple, and grayish-blue intermixed with white. The unaltered corundum is somewhat ferruginous and invariably contains crystals of rutile of different sizes disseminated through the whole mass. This corundum, however, is sometimes altered into a compact margarite, which coats the blue crystals, but generally into damourite and cyanite, which are associated with gold, granular quartz, etc. This alteration, however, goes frequently farther and leaves not a trace of corundum, and often nothing but scoriaeceous masses, the cavities frequently still containing small crystals of cyanite coated with a brownish-black limonite, and rutile in brilliant crystals or coated in the same manner. But there are two new products of the alteration associated with these, pyrophyllite and lazulite. The same association of cyanite, rutile, pyrophyllite and lazulite in an arenaceous sandrock is found at Graves Mountain, Lincoln County, Georgia, and although as far as I am aware, corundum has never been found at this place, there can be very little doubt that at this locality also all these

species except rutile and quartz owe their existence to the former presence and subsequent alterations of corundum.

The same is in all probability true with reference to the occurrences of pyrophyllite, both radiated, stellate, and the slaty in Montgomery, Randolph, Moore, Chatham, and Orange Counties of North Carolina, and perhaps Chesterfield District, South Carolina.

14. Staurolite.

With the damourite, resulting from the alteration of corundum at the Culsagee Mine, are found very few and minute brown grains of subvitreous lustre; the grains are massive and of irregular shape and do not show a trace of a crystalline form. Their spec. grav. was found to be = 3.711, and the analysis showed them to be staurolite. It gave:

SiO_2	=	27.91	contains oxygen	=	14.49	
Al_2O_3	=	52.92	" "		24.74	26.80
Fe_2O_3	=	6.87	" "		2.06	
FeO	=	7.80	" "		1.73	3.04
MgO	=	3.28	" "		1.31	
CaO and MnO	=	traces				
Ignition	=	1.59				
		100.37				

The oxygen ratio 3.04 : 26.80 : 14.49 is = 1 : 8.8 : 4.8 or near 1 : 9 : 5 giving the formula $2RO, SiO_2 + 2(3Al_2O_3, 2SiO_2)$.

15. Pyrophyllite.

In his "Chemical and mineralogical relations of the metamorphic rocks," T. S. Hunt* says: "*The last term in this exhaustive process appears to be represented by the disthene (cyanite) and pyrophyllite rocks, which occur in some regions of crystalline rocks.*"

I suggested under the heading "*cyanite*" that the pyrophyllite found in several of the Counties of North Carolina, South Carolina and Georgia, is the result of the alteration of the former, perhaps, from Al_2O_3, SiO_2 into Al_2O_3, $3SiO_2 + H_2O$.

This view is sustained by pseudomorphs of pyrophyllite in the form of cyanite from Villa Rica, in Brazil, described by F. Sandberger.†

An association very similar to that at Crowder's Mountain, North Carolina and elsewhere, viz.: cyanite, pyrophyllite, damourite, hematite, and lazulite, occurs at Horrsjöberg, in the District of Elfsdalen, in rutile Wermland and Westana in Sweden. That these were formed under similar circumstances cannot be doubted.

Several other hydrous aluminous minerals have been found in association with corundum or with minerals which are the product of its alteration; for example, those accompanying the beauxite in the southern

*T. S. Hunt, Sill, Journ. [2] XXXVI, 222.

†F. Sandberger, Leonhard—Broon's Jahrbuch der Mineralogie, 1855, 315.

part of France, the dillnite with the diaspore of Schemnitz, and others, of which the species has not been sufficiently identified; they are mostly amorphous and their relation to the corundum is not striking enough to dwell more fully upon them. I turn my attention now to

16. Damourite.

This species has been established on a mica-like mineral, an aggregate of fine scales, forming the gangue of cyanite at Pontivy, Brittany. It will be seen in the sequel that it is one of the most important products of alteration of corundum, from which it is either *directly* formed, or *indirectly*, after the corundum has first been changed into cyanite or fibrolite, which latter are subsequently converted into damourite. There is hardly a species, which assumes so many different shapes as this, and it is often impossible to determine it without analysis. S. P. Sharpless* was the first to prove that mica-like crystals, which accompany the diaspore from near Unionville, Newlin Township, Chester County, Pennsylvania, which always had been mistaken for margarite (emerylite) were damourite.

At Unionville, damourite is found in the following forms:

a. In crystals frequently having the lateral and sometimes the basal planes well developed; they appear to be hexagonal plates, but are probably rhombic. They are sometimes radiating and fan-shaped, and the crystalline plates from one to three inches in diameter. Their color is generally white to greenish-yellowish and brownish-white, but when treated with chlorhydric acid, which removes a little ferric hydrate which colors them, they are white with a very delicate shade of sea-green-rarely as deep as grass-green. Their lustre is pearly, sometimes inclining to vitreous.

These crystals or crystalline plates of larger or smaller size are directly attached to the granular grayish or brownish-white corundum or in the mass of the same; occasionally there is between them and the corundum a small seam of a crystallized dark-green chloritic mineral. Black tourmaline is another not uncommon associate, and especially, where the rare mineral diaspore appears, slender crystals of dark blueish, or brownish, green tourmaline are met with. This is the variety analyzed by S. P. Sharpless and Dr. G. A. Koenig (*a*).

b. Another variety of damourite consists of an aggregation of grayish and yellowish-white scales of one-sixteenth to not over one-quarter inches in diameter. After cleaning them with dilute chlorhydric acid they are silver-gray. They form a coating upon and sometimes occupy the whole of former corundum crystals and their aggregations are real pseudomorphs after corundum, generally with a core of original mineral. Dr. Isaac Lea has a fragment of a beautiful crystal of blue corundum over three inches in length and about two and a-half inches in diameter, which is coated with a coust of scaly damourite from one-eighth to one

*S. P. Sharpless, Sill. Journ. [2] XLVII, 319.

fourth inch in thickness. He very kindly furnished me with some for analysis (see below *b*1). He has presented me with a fine crystal of gray corundum, about two-thirds of which is changed into damourite. Col. Jos. Willcox, in his rich collection of American corundums, has several good crystals, of which he very generously contributed the material for analysis (see below, *b*2).

c. Another very beautiful variety of the same mineral forms also pseudomorphous crystals after corundum. The material for analysis was from a fragment of a crystal, showing on two sides the remnant of a pyramid. It contains a nucleus of gray corundum from which a very fine scaly white pearly damourite is radiating, giving it a pseudo-fibrous structure (*c*).

d. The scales of damourite occasionally become so fine that they cannot be distinguished with the naked eye and the mineral becomes massive, sometimes globular, sometimes with a slaty structure, similar to talc slate. This is often mixed with aggregation of larger scales of a greenish-white color and pearly lustre. Dr. Koenig has made an analysis of the massive globular greenish-white crypto-crystalline variety (see below, *d*).

e. A white or grayish-white variety of a fine scaly, often crypto-crystalline, structure, sometimes slaty, generally pseudo-fibrous, the apparent fibres from one-half to over six inches in length, frequently invests the granular grayish-white corundum. The lustre is generally very feeble, otherwise pearly, inclining to silky. Scales of damourite of a white or greenish color are disseminated through the white fibrous mass, sometimes in small veins or accumulating into masses to a scaly granular rock. An analysis of the pseudo-fibrous white damourite by Dr. Koenig is given below (*e*).

On one side and as a rule furthest from the corundum, it gradually becomes dull-green and changes into pure granular chlorite.

f. Next to the corundum is generally another variety of damourite, forming a seam between it and the white (*e*); it is from one-fourth to two inches in thickness.

Whilst crypto-crystalline and consisting of exceedingly minute scales, they are arranged in fibres at right angles to the corundum. This variety of damourite much resembles some kinds of serpentine. It has a yellowish oil-green color, its lustre is waxy or dull. It is remarkable that the slender crystals of tourmaline, which are frequent in the white variety (*e*) and which penetrate into the chlorite, have not been observed in any of the numerous specimens which I had for examination.

I shall give below my analysis of a sample, investing a mass of gray corundum (*f*1), and the mean of two analyses by Mr. Th. M. Chatard (*f*2), of a sample taken between the corundum and the white variety (*e*).

g. The highly interesting pseudomorphs of damourite after corundum from Laurens District, South Carolina, probably occur in mica slate. I have already stated that most of the crystals of corundum from this locality are coated with a micaceous mineral, which the analysis proved

to be damourite. The pseudo morphous crystals show the shape of the corundum but are flattened as if by exposure to a heavy pressure. Many still contain a nucleus of unaltered corundum, others are entirely changed. They are aggregates of small yellowish-white scales. The material, which I have analyzed, was first purified by dilute chlorhydric acid and then presented the appearance of silver-white scales (*g*).

h. Very similar is the damourite which forms a bed of *mica schist* at the Culsagee Mine. The scales are somewhat larger than those from South Carolina, and the corundum crystals which still exist in it, not quite as deeply altered. They are associated with small grains of massive staurolite and some other black minerals, probably menaccanite, etc. An analysis of the scales purified by chlorhydric acid was made by Dr. Koenig, the results of which is given below (*h*).

i. The damourite, investing the crystals and masses of blue corundum at Crowder's Mountain and resulting from its alteration, occurs in scales, which are generally coated with ferric hydrate. A sample purified by chlorhydric acid was analyzed by Mr. Thos. M. Chatard (see below, *i*).

The results of the analyses of the various varieties of damourite, are as follows :

	a.	*b*1.	*b*2.	*c*.	*d*.	*e*.
Spec. Gr. =	2.851	——	2.843	——	2.857	2.832
SiO_2 =	43.03	45.49	45.57	45.86	45.73	45.73
Al_2O_3	39.06		34.83	37.65	37.10	36.30
Fe_2O_3	1.48	2.34	2.94	0.59	1.30	0.83
MgO	0.30	——	0.83	0.55	0.34	0.54
CaO	trace.	——	0.40	0.31	trace.	0.74
Li_2O	trace.	——	trace.	trace.	trace.	trace.
Na_2O	0.58	0.32	0.87	0.80	0.88	0.58
K_2O	10.05	9.88	10.16	10.40	10.50	10.49
Ignition	5.40	3.89	5.30	4.74	4.48	5.17
	99.90		100.90	100.90	100.33	100.38

	*f*1..	*f*2.	*g*.	*h*.	*i*.
Spec. Gr. =	2.779	2.760	——	2.867	2.860
SiO_2	46.98	46.60	45.71	45.62	43.51*
Al_2O_3	35.13	32.39	34.12	35.93	37.85
Fe_2O_3	0.61	2.54	3.45	2.93	
MgO	1.32	2.01	0.71	0.34	0.31
CaO	0.13	trace.	0.48	trace.	0.42
Li_2O	trace.	trace.	trace.	trace.	trace.
Na_2O	0.76	0.54	0.49	0.71	1.04
K_2O	10.74	10.39	10.36	9.40	11.35
Ignition	4.77	4.81	4.67	4.93	7.73*
	100.44	99.28	99.99	99.86	102.21

* Mean of three determinations.

Although the object of many of these analyses was only to determine the species, the material for investigation was selected with great care. Some of them, notwithstanding, contained minute quantities of corundum, by which the per centage of the silica or alumina is slightly increased; the majority, however, fully agree with the established composition of damourite, the constituents of which have the oxygen ratio:
$RO : R_2O_3 : SiO_2 : H_2O = 1 : 9 : 12 : 2$.

Only the damourite from Crowder's Mountain would give for water the ratio: 3. This is the result of three determinations, all agreeing with each other. Some of the damourite varieties have a portion of the alumina replaced by the ferric oxide.

17. Ephesite. Lesleyite.

In his investigations on *emery*, J. L. Smith (*l. c.*) describes under the name "*ephesite*," a mineral which he states to have a lamellar structure and to resemble white cyanite. I will give below the analysis of ephesite, by Dr. Smith, and also one, which I made from material kindly furnished me by him for my investigations on corundum. It will be seen that they compare pretty well. I must add, however, that Dr. Smith's analysis should be considered the better, because he had a larger quantity and probably cleaner material for his examination. The main object of *my* analysis was to see whether ephesite contains a *mechanical admixture of corundum*, which was most conclusively proven.

Not having had an opportunity to see ephesite, Dr. Isaac Lea called (*l. c.*) a similar mineral from Unionville, *lesleyite*. He recognized the change of the hard corundum into soft minerals and in the absence of analyses, he considered all those which were fibrous and compact as identical. This is undoubtedly a very excusable error, because it is next to impossible to distinguish these minerals without chemical tests, and credit should be given to him for having brought to light these interesting varieties.

Of the fibrous and compact damourites I have already spoken, the margarite belonging here, I shall consider afterwards; I now will dwell only upon such varieties, as have been generally recognized as *true lesleyites*. Some of these have been the subject of investigations by S. P. Sharpless,* and Dr. J. L. Smith,† and of observations by G. J. Brush.‡ There are three principal varieties of lesleyite.

a. The first is fibrous and divergent. It is slightly grayish-white, the surface is discolored by ferric hydrate, but interior of the mass appears to be free from it. Its lustre is pearly inclining to silky, it is scratched by fluorite, but scratches quartz easily, and is associated with scaly damourite.

b. The second variety resembles the first very much, but is more ferru-

*S. P. Sharpless, Sill. Journ. [2] XLVII, 319.

†J. L. Smith, Sill. Journ. [2] XLVIII, 254.

‡G. J. Brush, Appendix to 5th edit. of Dana's Mineralogy, New York, 1872.

ginous and less pure; it is associated with damourite and pattersonite. It has small cavities through the whole mass. Its color is reddish.

c. The third variety has frequently a chloritic mineral intermixed with it. The lesleyite itself is fine fibrous columnar, sometimes divergent; its color is between grayish-greenish and brownish-white, and its lustre between silky and vitreous. It is easily scratched by the knife, but is harder than apatite. Some parts of it scratch quartz.

Mr. Thos. M. Chatard and I analyzed the white variety *a*; and Dr. Koenig and I the varieties *b* and *c*; to which, for comparison, are added the analyses of S. P. Sharpless and J. L. Smith.

Ephesite:

	J. L. Smith.	Genth.
SiO_2 =	30.70	31.34
Al_2O_3	55.67	55.55
Fe_2O_3	——	1.04
MgO (trace MnO)	——	trace.
CaO	2.55	3.82
Li_2O	——	trace.
Na_2O	5.52	3.27
K_2O	1.10	1.68
Ignition	4.91	5.12
	100.45	101.72

The fusion with calcic carbonate with ammonic chloride gave me 10.26 *per cent. of corundum.*

The oxygen ratios for RO : R_2O_3 : SiO_2 : H_2O are:

Smith = 2.34 : 25.94 : 16.37 : 4.36 = 1 : 11.1 : 7 : 1.9

Genth = 2.22 : 26.20 : 16.72 : 4.55 = 1 : 11.8 : 7.5 : 2.0.

I have endeavored to calculate from these data the probable composition of this mixture, but failed. If we had any means to determine the *actual* amount of free corundum, *which I suppose will be between* 15 *and* 20 *per cent.*, we would propably have better success.

Lesleyite:

	a. White.			*b. Reddish.*		
	Genth.	Chatard.	Sharpless.	Genth.	Koenig.	C.W.Roepper
Sp. Gr. =		3.200	3.203		3.059	2.870
SiO_2 =	32.32	32.32	33.59	21.96	31.90	47.00
Al_2O_3	56.43	55.23	55.41	56.85	54.09	33.27
Fe_2O_3	0.29	——	——		0.51	2.84
MgO	0.38	0.73	——	0.13	0.34	——
CaO	0.32		——	0.13	——	——
Li_2O	faint traces.		——	faint traces.		——
Na_2O	0.32	0.64	——	0.35	1.01	——
K_2O	7.31	7.82	7.43	7.83	8.71	9.97
Ignition	4.01	3.86	4.30	4.09	4.20	6.71
	101.38	100.60	100.73	101.34	100.76	99.79

In the analysis of *a*, I found by the fusion with calcic carbonate and ammonic chloride 21.40 per cent., and in *b*, 17.78 per cent. of *free corundum.*

The analysis of the reddish variety by C. W. Roepper contains evidently about 15 per cent. *of corundum in the silicic acid* which he found.

S. P. Sharpless suggested that both varieties are *the products of the action of water containing alkaline silicates upon corundum, and are more nearly related to pinite than to any other mineral species*; Prof. Brush, that both ephesite and lesleyite *are mixtures of corundum, and probably diaspore, with a mica, similar to the damourite found at the lesleyite locality; and that the foliated soft material is damourite or a hydrous mica near that species.*

In my investigations I had already ascertained that lesleyite contains a large per centage of free corundum, when I received the *Appendix to Dana's Mineralogy by Prof. Brush*, and I am happy to be able to prove that, at least, the greater part of his suggestions are correct.

I do not believe that there is any admixture of diaspore, but calculating from the amount of potash found in the white lesleyite the per centages requisite for a damourite, most similar in appearance to it (see analysis of damourite *e* by Dr. Koenig), we get :

SiO_2	=	31.87			
Al_2O_3	=	25.30			
Na_2O	=	0.40	=	68.48	Damourite.
K_2O	=	7.31			
H_2O	=	3.60			
				30.00	Corundum.
				1.52	Silicates, etc.

The analysis of Sharpless gives about 69 per cent. of damourite and nearly the same amount of corundum as my own.

The calculation of the analysis of the reddish variety gives less satisfactory results, owing to the greater impurity of the mineral; but it corresponds with about 70 per cent. of damourite, 27 per cent. of corundum and 3 per cent. of other admixtures.

c. The third variety of lesleyite is of an entirely different nature. The analysis gave :

		Genth.	Koenig.
Sp. Gr.	=	———	3.157
SiO_2	=	35.68	34.80
Al_2O_3		60.29	59.77
Fe_2O_3		0.72	0.73
MgO		0.29	———
Li_2O		faintest trace.	———
Na_2O		0.41	not det'd.
K_2O		0.96	not det'd.
Ignition		1.78	2.05
Corundum		———	2.20
		100.13	99.55

By the fusion with calcic carbonate and ammonic chloride I obtained 11.08 per cent. of corundum; the 2.20 per cent of corundum in Dr. Koenig's analysis remained unacted upon by the fusion with sodic carbonate.

The oxygen ratios in these analysis is for RO : R_2O_3 : SiO_2 : H_2O, as follows:

Genth = 0.39 : 28.32 : 19.03 : 1.58 = 1 : 72.6 : 48.8 : 4
Koenig = (0.39) ass'd : 28.07 : 18.56 : 2.05 = 1 : 72.0 : 47.6 : 5.3.

It will be seen that the ratio of R_2O_3 : SiO_2 is exactly = 3 : 2, which is that of fibrolite. Although it is very probable that this variety, like the two others is *originally an alteration of corundum into fibrolite*, the latter is almost completely changed in the first two varieties and to a great extent already in the third. I did not succeed in calculating from the small quantities of potash, soda and magnesia any of the admixtures. The 11.08 per cent. of corundum which I found, indicate the presence of probably about 15 or 16 per cent. of this substance.

18. Paragonite.

A highly interesting occurrence of corundum is that at "Ochsenkopf," near Schwarzenberg, in Saxony. It is found in granular masses or isolated grains of a blueish-gray color in a slaty rock of a brownish ash-gray color. Associated with the corundum are small scales of dark green chloritoid and a minute quantity of a foliated white brilliant mineral, which is probably diaspore. The slaty matrix consists of very fine white and brownish-white scales, and the whole appearance is so very similar to that of some varieties of damourite resulting from the alteration of corundum, that I considered a chemical analysis as very desirable. The material for it was selected with great care and was found to have the following composition:

SiO_2	=	43.70
TiO_2	=	3.50
Al_2O_3		39.60
Fe_2O_3		0.66
MgO		trace.
CaO		0.56
Li_2O		trace.
Na_2O		6.52
K_2O		0.93
Ignition		4.83
		100.30

The presence of titanic acid was surprising, as no rutile could be detected with a very good magnifying glass in any of the particles. Some of the slate was therefore carefully crushed without grinding and the lighter particles were washed off. The heavier residue, when examined under the microscope, showed numerous grains of yellowish-brown rutile.

Deducting this from the analysis, the composition of this slate is that of paragonite, the analyses of a variety of which, from St. Gothard by Rammelsberg, and of another from Pregatten, in Tyrol (Pregattite) by Oellacher, I will give for comparison :

	St. Gothard.	Pregatten.	Ochsenkopf.				
SiO_2 =	46.81	44.65	45.14	contains oxygen		24.07	
Al_2O_3	40.06	40.41	40.91	"	"	19.06	19.26
Cr_2O_3	——	0.10	——				
Fe_2O_3	trace.	FeO=0.84	Fe_2O_3=0.68	"	"	0.20	
MgO	0.65	0.37	trace.				
CaO	1.26	0.52	0.58	"	"	0.17	2.07
Na_2O	6.40	7.06	6.74	"	"	1.74	
K_2O	trace.	1.71	0.96	"	"	0.16	
Ignition=	4.82	5.04	4.99	"	"	4.44	
	100.00	100.70	100.00				

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O is equal to 1 : 9.3 : 11.6 : 2.1 or very near to 1 : 9 : 12 : 2, which is that of damourite.

Paragonite is essentially a *soda damourite.*

The mineral from the Ochsenkopf analyzed by John does not belong to this species.†

I have above alluded to a peculiar rock, a slaty fibrolite with staurolite and cyanite, found in the neighborhood of Media, Delaware County, Pennsylvania, and also near the Culsagee Mine, in Macon County, North Carolina, and stated that the whole appearance of these slates was that of the paragonite slates of St. Gothard. After having already proved the alteration of corundum and fibrolite into damourite, and that of the Ochsenkopf corundum into paragonite, the question suggests itself—*may not the whole of the paragonite slates of St. Gothard and elsewhere be the result of the alteration of corundum or fibrolite?*

19. Euphyllite.

Euphyllite accompanied by tourmaline and zoisite is a very rare associate of corundum at Unionville. It is undoubtedly like the others, resulting from its alteration. As I had not a sufficient quantity of pure material, no new analysis has been made, and really there was no necessity for it, because the analyses of Smith and Brush leave no doubt about its composition.

The micaceous mineral, which is found with the corundum and albite near Unionville, and which resembles muscovite, gave Dr. Koenig in two partial analyses about 42 per cent. of silicic acid.

This is undoubtedly the same as that analyzed by Sharpless* and those of a similar per centage of silicic acid from Asia Minor and Nicaria, analyzed by J. L. Smith.

20. Jefferisite.

Jefferisite, a species first distinguished by Prof. Brush, is frequently he result of the alteration of chlorite, hence indirectly of corundum. At

† Dana's Mineralogy, 5 edit., 482.

* Dana's Mineralogy, 5 edit., 489.

the Unionville locality it is rarely met with, but sometimes it is found in irregular and imperfect hexagonal plates and crystals of a brownish-yellow color. It exfoliates like that from West Chester.

At the Culsagee Mine it is of more frequent occurrence, and the chlorite shows very often an incipient alteration by a discoloration of the laminae, which turns brown or brownish-yellow. It is generally found, when completely altered, in plated masses of a yellowish-brown color, which cannot be distinguished by their physical characters and their manner of exfoliation, from that of the original locality. There is another variety at the Culsagee Mine, which is associated with a considerable quantity of corundum. It occurs in fine greenish-brownish-yellow scales, not over one-eighth of an inch in diameter. It exfoliates, but not as remarkably as either of the other varieties.

The following were analyzed:

a. The broadly foliated, from the Culsagee Mine by Dr. Koenig (*a* 1) and Mr. Thos. M. Chatard (*a* 2).

b. The greenish-brownish-yellow fine scaly, by Mr. Thos. M. Chatard (*b*.)

c. and for comparison the broadly foliated from West Chester, by Dr. Koenig (*c* 1) and Mr. Thos. M. Chatard (*c* 2), to which is added (*c* 3) the analysis by Prof. Brush.

	Culsagee.			West Chester.		
	a. 1.	*a* 2.	*b*.	*c* 1.	*c* 2.	*c* 3.
SiO_2 =	33.93	33.77	34.00	33.35	34.40	37.10
Al_2O_3	17.38	17.56	20.36	17.78	16.63	17.57
Fe_2O_3	5.42	5.61	4.91	7.32	8.00	10.54
FeO	0.50	0.50*	0.42	2.11	2.11*	1.26
NiO	0.35	not det'd.	0.57	—	—	—
MgO	23.43	22.48	21.71	19.26	19.30	19.65
CaO	—	—	—	—	—	0.56
Na_2O	—	—	—	not det'd	not det'd	trace.
K_2O	—	—	—	"	"	0.43
Ignition	19.17	20.30	18.50	19.87	19.03	13.76
	100.18	100.22	100.47	99.69	99.47	100.87

The oxygen ratios for RO : R_2O_3 : SiO_2 : H_2O are as follows:

*a*1	=	2.94	:	3	:	5.59	:	5.26
*a*2	=	2.77	:	3	:	5.48	:	5.49
b	=	2.43	:	3	:	5.00	:	4.50
*c*1	=	2.33	:	3	:	5.09	:	5.05
*c*2	=	2.42	:	3	:	5.42	:	5.00
*c*3	=	2.21	:	3	:	5.23	:	3.23

The discrepancies in these analyses hardly admit of constructing a formula. The analyses *a*1 and 2 give nearly $6RO + 2R_2O_3 + 5SiO_2 + 10H_2O$, and *b*, *c*1 and 2 nearly $5RO + 2R_2O_3 + 5SiO_2 + 10\ H_2O$.

The greatest, and to me unexplainable difference, exists in the results of Prof. Brush and Dr. Koenig and Mr. Chatard in the amount of silicic acid and water in the West Chester Jefferisite. Dr. Koenig made his analysis with finely powdered material, which has been exposed to the dry air of the room; Mr. Chatard took his material from another specimen, and after powdering, dried it for *four days over sulphuric acid in a vacuum;* in the same manner the Culsagee mineral was treated.

*Mr. Chatard determined only the ferric oxide, and took for the ferrous oxide Dr. Koenig's result.

21. Chlorite.

I have mentioned in the geological outline, that chlorite rocks have been observed in almost every locality where corundum occurs in large masses or beds. It remains to examine into a number of peculiar associations between chlorite and corundum, in order to point out their relation to that of the entire chloritic beds.

a. Near Unionville, in the shaft alongside of the road to Kennett Square, chlorite occurs very conspicuously; it is intimately mixed with spinel, containing a considerable admixture of corundum (see above). The results of the explorations there, were not sufficiently encouraging, and the mining operations have therefore been abandoned. They have furnished, however, a few interesting scientific facts, as I have shown.

b. At the principal Unionville locality, chlorite is found under various circumstances. It sometimes forms a lining of minute dark green crystals, between the corundum and the foliated damourite; then, it is disseminated through the corundum in small scales or seams; and again it is met with, adjoining the large corundum bed, in boulder-like masses of fine scales, showing a lamination around a centre, which frequently, in breaking them open, consists of a nucleus of granular corundum. This chlorite is of a dull olive-green color, but often under the influence of the atmosphere, converted into reddish or yellowish-brown scales or even a ferruginous clay.

In a specimen in the University collection of nearly one foot in diameter, there seems to have been a fracture in the granular corundum, which allowed the liquid, producing the alteration, to percolate to the centre of the mass, and to deposit in the heart of the specimen, a small quantity of green chlorite, surrounded by a concentric layer of white granular corundum, upon which is a layer of scaly chlorite, slightly ferruginous and yellowish in immediate contact with the corundum, graduating into green. The whole nucleus, of about two inches in diameter is enveloped in a mass of yellowish-gray and brownish decomposed chlorite, of which I shall give two analyses by Dr. Koenig. (*b*, 1 and 2).

c. Another variety of chlorite from Unionville, originates from the alteration of damourite and tourmaline, which two minerals result from that of corundum. The white pseudo-fibrous variety of damourite (*c*), gradually assumes a slightly greenish tint from an admixture of fine scales of chlorite, which rapidly increases and soon form a massive variety of a light olive-green finely granular chlorite. The slender tourmaline crystals, which start in the white damourite, pass on into the chlorite, but for a short distance only; they are soon entirely altered into fine scaly chlorite, and these pseudomorphs of chlorite after tourmaline, are imbedded in the granular matrix like the original tourmaline. This is a highly interesting occurrence, and quite similar to that described by G. Rose (l. c.), as occurring in the chlorite slates associated with corundum, at Kassoibrod in the Ural.

Mr. Thos. M. Chatard has furnished me with two analyses, (*c*, 1 and 2)

of this fine scaly granular chlorite, and another one, which I shall copy for comparison (*c*. 3) has lately been published by A. R. Leeds, in his contributions to mineralogy.*

d. The Culsagee Mine, near Franklin, North Carolina, has furnished a great variety of specimens of extraordinary interest.

There are some, which are aggregations of dark green foliated chlorite, having distinctly visible the rough outlines of hexagonal crystals of corundum, and in their centre the unaltered mineral; others again are more irregular in shape, and appear to have been fragments of massive corundum before they were converted. The nuclei of unaltered corundum, are often free from any admixtures, often, however, containing through their mass laminae of chlorite, at times in large quantities.

But there are frequently specimens met with containing *perfect and brilliant crystals* of corundum, which appear to have formed *after* a great portion of the original corundum had changed into chlorite, as if there had been an excess of alumina ready for combination, which, not finding a supply of the requisite amount of silicic acid and bases, had again crystallized as corundum.

The chlorite in immediate contact with the unaltered minerals, whether corundum or spinel, has often a fine scaly pseudo-fibrous structure, which at a greater distance assumes the more laminated shape; however, a great portion is laminated, where it touches either spinel or corundum, and in reality some of the largest plates, three or four inches in diameter, contain a considerable quantity of corundum disseminated through their mass.

The following varieties from the Culsagee Mine were analyzed; broadly foliated dark-green (*d*1) by myself, (*d*2 and 3) by Mr. Thos. M. Chatard, and a fine scaly variety diverging from corundum, (*d*4 and 5), by myself.

e. Similar nuclei of unaltered corundum in foliated chlorite have been observed amongst the specimens from Shooting Creek, Clay County, North Carolina.

The decomposed chlorites from Unionville gave:

		*b*1 *Brownish-red.*	*b*2 *Yellowish-gray.*
SiO_2	=	31.35	32.80
Al_2O_3	=	21.58	26.07
Fe_2O_3	=	14.17	9.80
MgO	=	16.67	17.70
Ignition	=	14.45	13.75
		98.22	100.12

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O is very near = 1.5 : 3 : 3.5 : 2.5, which can be expressed by the formula: 2(3 RO, 2 SiO_2)

*A. R. Leeds, Sill. Journ. [3] VI, 25.

$+ (4R_2O_3, 3 SiO_2) + 10 H_2O$, representing the product of the decomposition of chlorite.

		*c*1.	*c*2.	*c*3.		
SiO_2	=	29.43	29.59	30.62		
Al_2O_3		22.08	22.18	21.73		
Fe_2O_3		1.41	1.33	0.42		
FeO		5.64	5.77	5.01		
MgO		28.46	28.54	29.69		
Li_2O		not det'd.	not det'd.	0.11		
Na_2O		"	"	0.14		
Ignition		12.40	12 40	12.26		
		99.42	99.81	99.98		
		*d*1.	*d*2.	*d*3.	*d*4.	*d*5.
SiO_2	=	27.56	27.28	27.17	29.48	29.59
Al_2O_3	=	22.75	22.11	22.35	22.22	not det'd
Fe_2O_3	=	2.56	2.50	2.71	0.70	0.64
FeO	=	5.43	5.43	5.43	5.30	not det'd
(NiCo) O	=	0.30	0.41	0.26	0.11	"
MnO	=				0.17	"
MgO	=	28.47	28.34	27.73	30.99	30.88
Ignition	=	13.80	14.50	14.36	11.63	11.56
		100.87	100.42	100.01	100.60	

Particular attention was paid to the state of oxidation in which the iron exists; the ferric oxide is not due, as Prof. Leeds suggests, to *a superficial oxidation of some of the ferrous oxide in the mineral*, but is an essential constituent of the chlorites, and its presence makes a considerable difference in the relative proportions of the protoxides and sesquioxides.

The oxygen ratio of $RO : R_2O_3 : SiO_2 : H_2O$ of the analyses of chlorites, above given, is as follows:

*c*1	=	3.50	: 3 :	4.40	:	3.09
*c*2	=	3.50	: 3 :	4.40	:	3.08
*c*3*	=	3.83	: 3 :	4.78	:	3.19
*d*1	=	3.66	: 3 :	4.20	:	3.55
*d*2	=	3.43	: 3 :	3.95	:	3.50
*d*3	=	3.30	: 3 :	3.87	:	3.41
*d*4	=	3.84	: 3 :	4.65	:	2.93

This is nearest to 7 : 6 : 8 : 6, which would correspond with the formula suggested by Rammelsberg:

$$4 RO, SiO_2 + 3 RO, 2 R_2O_3 + 6 H_2O.$$

All these chlorites belong to the species, which was called ripidolite by G. Rose, but which is now distinguished by Dana as prochlorite.

* Besides the printer's mistake in Prof. Leeds oxygen ratio, I have corrected it in accordance with my views about the state of oxidation of the iron.

Besides the jeffersite there appear to be other products of the alteration of chlorite, at the Culsagee Mine, Nos. 22 and 23, which appear to be new.

22. Kerrite (a new mineral).

It consists of innumerable fine scales, which under the microscope do not present a definite shape. They are very soft. Sp. Gr. = 2.303, Chatard. Their color is pale greenish-yellow with tint of brown; their lustre is pearly.

When heated they exfoliate, but not as much as jeffersite; B. B. melts to a white enamel. Chlorhydric acid decomposes it easily with separation of silicic acid in pearly scales. No corundum has been found in the scaly aggregates, but sometimes plates of green chlorite are intermixed with it. It is named in honor of Prof. W. C. Kerr, State Geologist of North Carolina.

It was analyzed by Mr. Thos. M. Chatard with material, which was examined under the microscope and apparently perfectly pure. He found:

				Mean.		Oxygen.
SiO_2	=	38.31	38.26	38.29		20.42
Al_2O_3	=	11.41	11.42	11.41	5.32	5.91
Fe_2O_3	=	1.93	1.97	1.95	0.59	
FeO	=	0.32	0.32	0.32	0.07	
(NiCo) O	=	0.29	0.22	0.25	0.05	10.66
MgO	=	26.30	26.50	26.40	10.46	
Ignition	=	21.22	21.28	21.25		18.89
		99.78	99.97			

The average of the two analyses gave the ratio of oxygen of RO : R_2O_3 : SiO_2 : H_2O = 5.4 : 3 : 10.3 : 9.5, which is nearly = 6 : 3 : 10 : 10, represented by the formula:

$$2(3RO, 2\,SiO_2) + (R_2O_3, SiO_2) + 10\,H_2O.$$

23. Maconite (a new species).

This is another scaly mineral, and closely resembles a fine scaly jeffersite. The scales are slightly harder than the last, and under the microscope they are also irregular. Sp. Gr. = 2.827, Chatard. They are dark brown, their lustre pearly inclining to submetallic. When heated, exfoliates largely and fuses with difficulty to a brown glass. Easily decomposed by chlorhydric acid with separation of silicic acid in pearly scales.

Contains numerous fragments of dark blueish-gray corundum, and microscopic apparently triclinic brilliant reddish-brown crystals which may be *sphene*. Name from Macon County, North Carolina.

Two analyses of apparently perfectly pure material were made by Mr.

Thos. M. Chatard. The alcalies in the second analysis were determined by myself.

			Mean.		Oxygen.
SiO_2	= 34.24	34.20	34.22		18.25
Al_2O_3	21.41	21.66	21.53	10.03	13.75
Fe_2O_3	12.28	12.54	12.41	3.72	
FeO	0.32	0.32	0.32	0.07	
(NiCo) O	0.11	0.13	0.12	0.03	
MgO	14.30	14.61	14.46	5.78	6.98
Li_2O	trace.	trace.	trace.		
Na_2O	0.53	0.50	0.51	0.13	
K_2O	5.49	5.91	5.70	0.97	
Ignition	11.81	11.90	11.85		10.53
Corundum	0.20	———			
	100.69	101.77			

The oxygen ratio of an average of the two analyses for RO : R_2O_3 : SiO_2 : H_2O is = 1.52 : 3 : 3.98 : 2.3 = 3 : 6 : 8 : 5 nearly, giving the formula : 3 RO, 2 SiO_2 + 2 (R_2O_3, SiO_2) + 5 H_2O.

About one-sixth of RO are alcalies R_2O.

24. Willcoxite (a new species).

There is still another mineral which appears to be new. It consists of white and greenish-white or grayish-white scales of a pearly lustre, and much resembles talc. B. B. in thin splinters, it fuses with difficulty into a white enamel; colors the outer flame yellow. With chlorhydric acid decomposed with difficulty with separation of silicic acid in pearly scales. It occurs sparingly, and I have seen it only in connection with corundum as a result of its alteration. One specimen from Shooting Creek, Clay County, North Carolina, is a fragment of a semiglobular mass, which probably once consisted entirely of corundum and which now has a nucleus of white lamellar corundum, invested with the scaly mineral. The largest diameter of the specimen is two and a-half inches, and that of the core of corundum three-fourths of an inch.

It is named in honor of Col. Joseph Willcox, who presented me with the specimen from Shooting Creek, and who possesses a still larger, but otherwise very similar one.

It is found more or less intermixed with white corundum at the Cullakenee Mine, in Clay County, and probably at the Culsagee Mine, in Macon County, if a specimen of a grayish and greenish-white scaly mineral with a nucleus of white corundum which I received from there, really comes from this locality.

Dr. Geo. A. Koenig furnished me with two analyses of this mineral (1) from material from the Shooting Creek specimen surrounding the nucleus

of corundum, the other (2) from a piece from the Cullakenee Mine, Clay County, North Carolina.

		1.	2	Mean.	Oxygen.	
SiO_2	=	28.96	29.50	29.23	15.59	
Al_2O_3		37.49	37.56	37.52	17.48	17.88
Fe_2O_3		1.26	1.40	1.33	0.40	
FeO		2.44	2.38	2.41	0.54	
MgO		17.35	17.20	17.28	6.91	
Li_2O		trace.	trace.	trace.		9.53
Na_2O		6.73	6.24	6.48	1.67	
K_2O		2.46	2.42	2.44	0.41	
Ignition		4.00	3.32	3.66	3.20	
		100.69	100.02	100.35		

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O = 1 : 1.88 : 1.64 : 0.33, which is nearest to 6 : 12 : 10 : 2, which can be expressed by the formula : 3 (2 RO, SiO_2) + 2 (2 R_2O_3, SiO_2) + 2 H_2O.

About one-fifth of RO are alcalies R_2O.

25. Pattersonite.

The chloritic mineral associated with the lesleyite at Unionville and described by J. Lea (*l. c.*) under the name of pattersonite, has been analyzed by S. P. Sharpless (*l. c.*) who determined, as he says, the potash by difference, and gives 11.35 per cent. of it. But (as Prof. Brush first pointed out) his analysis, exclusive of the potash, sums up only 78.64 per cent. A re-examination was therefore very desirable. Dr. J. Lea has very generously furnished for this purpose the material of this rare mineral, of which I have made the following analyses:

Sp. Gr. = 2.810.

		Nearly Pure.	Purest.				
SiO_2	=	29.89	29.90	contains oxygen		15.95	
Al_2O_3		30.87	27.59	"	"	12.86	13.80
Fe_2O_3			3.12	"	"	0.94	
FeO		9.17	9.17	"	"	2.04	
MgO		17.53	17.10	"	"	6.84	
Li_2O		trace.	trace.				9.43
Na_2O		0.83	0.58	"	"	0.15	
K_2O		2.41	2.33	"	"	0.40	
Ignition		11.60	11.51	"	"	10.23	
		102.30	101.30				

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O is = 2.05 : 3 : 3.47 : 2.22 = 6 : 9 : 10 : 6, corresponding with : 2 (3 RO, SiO_2) + 3 (R_2O_3, SiO_2) + 6 H_2O.

The oxygen ratio is very near that of thuringite, which is 1 : 1.5 : 1.5 : 1.

26. Chloritoid.

This mineral has been observed at many of the corundum localities. It is associated with diaspore, mica and cyanite as Kassoibrod in the Ural; in Asia Minor with corundum, diaspore and margarite; at Chester, Massachusetts, with emery and diaspore. One specimen from Augusta County, Virginia, consists of chloritoid, damourite and grains of corundum; I found one little crystal in the washings of the soil from the Culsagee Mine. A very interesting occurrence is that in the pyrophyllite slates of Chatham County, North Carolina, where it occurs in minute shining scales of a dark blackish-green color disseminated through the white rock. With great difficulty I have selected a quantity of apparently pure material for analysis.

Sp. Gr. = 3.353.

SiO_2	= 26.13	contains oxygen = 13.94		
Al_2O_3	40.11	18.69	19.72	
Fe_2O_3	3.44	1.03		
FeO	23.01	5.11	5.49	
MnO	trace.			
MgO	0.94	0.38		
Ignition	6.91	6.14		
	100.54			

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O is = 0.83 : 3 : 2.12 : 0.97 = 4 : 15 : 10 : 4, giving the formula : 4 RO, SiO_2 + 5 R_2O_3, 4 SiO_2 + 4 H_2O, which corresponds closer to my analysis than the formula 4 RO, SiO_2 + 4 R_2O_3, 3 SiO_2, which is generally given. However, there may have been a minute quantity of pyrophyllite in my material which might be the cause of this discrepancy.

27. Margarite.

This species had been known for a long time from one locality, Sterzing in Tyrol, but not until the almost simultaneous discovery of it in association with the corundum from Pennsylvania and North Carolina, by B. Silliman and with emery in Asia Minor and Greece by J. L. Smith, its importance became apparent. Since then it has been observed almost everywhere with corundum, but a great portion of the laminated varieties of damourite have been confounded with it; it so much resembles the latter in all its varieties, that the only safe way for distinction is by chemical analysis.

At Unionville, many of the corundum crystals have a coating of a soft mineral, and sometimes the whole mass of the crystals is converted into it; a qualitative analysis proved these coatings to be margarite. More fully investigated were the following varieties:

a. A part of a crystal, showing the basal plane *o*, and a pyramid, which seems to be $\frac{1}{2}2$ and consisting of a grayish-white soft mineral. To the naked eye it looks like an amorphous substance without lustre.

With a strong magnifying glass it is shown to be crystalline, and to consist of exceedingly minute scales with a pearly lustre, radiating from a nucleus of gray corundum, which occupies the centre of the crystal, so that the cryptocrystalline mineral has a somewhat fibrous (pseudofibrous) structure. On the outside of the mineral are small scales of damourite. I have made two analyses of the *purest* cryptocrystalline mineral, which closely corresponded, and of which I give below the mean result (*a*1.) For corroboration, I have made a third analysis of material, which was not as pure and contained a few scales of the damourite, the influence of which upon the analysis (*a*2.) will be noticed by the increased amounts of silicic acid and potash and a reduction in the quantity of lime.

b. A laminated white variety, having a very faint reddish tint, occurs rarely with the granular corundum recently discovered. It it associated with black tourmaline and forms a coating upon or small veins in the grayish-white corundum. The laminae are sometimes nearly one inch broad, but usually smaller. My analysis is given below (*b*.)

c. An aggregation of fine scales and laminae somewhat of a granular structure, also of a white color with a faint reddish hue, and associated with black tourmaline, appeared to be a mixture of margarite with corundum; on powdering, however, it was found to be almost free from the original mineral, which existed in it only in very minute grains. The carefully selected material was analyzed by Dr. G. A. Koenig (*c*).

d. A massive apparently compact or finely granular variety, has lately been found with the granular corundum; strongly magnified it appears as an aggregate of very small scales; on one side they are bounded by an aggregate of larger scales, intermixed with chlorite. Its color is white, but there are many ferruginous brownish-yellow spots disseminated through the mass. The purest which could be selected was analyzed by myself (*d*).

e. A compact variety, frequently containing fragments of unaltered corundum, has been analyzed by Mr. Thos. M. Chatard (*e*). It has a grayish-white to brownish-white color, and breaks easily into angular fragments of one or two inches in size, which are generally coated with hydrated ferric and manganic oxides. The margarite itself shows under the microscope a cryptocrystalline structure, it has a slight waxy lustre.

f. The margarite, which was found associated with the boulder of blue corundum, near the French Broad River, Madison County (formerly Buncombe County), North Carolina, has been analyzed by B. Silliman (l. c.).

g. At the Culsagee Mine, North Carolina, margarite is a rare mineral. I have noticed it only in a rock, consisting of a feldspathic mineral, mostly decomposed into kaolinite, a greenish hornblende, and small quantities of a chloritic mineral, the whole mass intermixed with white and pink corundum and laminae of margarite. (I have not mentioned this rock above, because its occurrence seems to be local and I have no further information about it).

The pure margarite is white and has a pearly lustre. It has been analyzed by myself (*g*1) and Mr. Chatard (*g*2).

h. The most beautiful varieties of margarite occur at the Cullakenee Mine, North Carolina. Here it occurs in groups of laminated crystals, distinctly showing the lateral planes of the same. The largest group, which I have seen is two inches long, one and a-half wide and five-eighths inches thick. The color of the basal cleavage planes is brownish-white, but after treatment with dilute chlorhydric acid, which removes a thin coating of ferric hydrate, the color is slightly pinkish-white with a hue of silver-gray; the lateral planes have a darker color.

Tourmaline is sometimes inclosed between the laminae, and they are in some of the specimens intersected by crystals of an unknown mineral, to which I have already alluded. The most important association, however, are the nuclei of corundum, completely invested by the groups of laminated margarite. There are also scales of a bronze or brownish-yellow mineral, probably the result of the alteration of margarite, which I shall describe farther on as dudleyite. Mr. T. M. Chatard has analyzed this variety (*h*1).

Another from the same locality occurs as the product of the change of grayish-white corundum. It is frequently associated with zoisite, and intermixed with corundum in the form of broad laminae of a delicate pink color. I have made an analysis of it (see *h*2 below).

Associated with the mineral which I described as willcoxite, rarely occurs a somewhat fibrous variety made up of microscopic scales of margarite of a pearly lustre. It resembles much the variety of damourite *e*, but was found by qualitative analysis to be margarite, containing a considerable quantity of lime, but no potash. It completely surrounds a mass of gray corundum.

Still another variety from the Cullakenee Mine is found in thin seams of a grayish-green color. When magnified, the mineral consists of an aggregate of minute pearly scales of a greenish-white and sea-green color. I give the analysis, which I made under *h*3.

i. Crystalline masses of gray corundum from near Penland's, Clay County, North Carolina, which I have examined, are coated with a cryptocrystalline pseudofibrous mineral of a white and yellowish-white color, which gave by qualitative analysis, a considerable quantity of lime, but no potash, and which therefore appears to be margarite.

A similar coating containing lime, is sometimes found on the blue crystals of corundum from Crowder's Mountain, Gaston County, North Carolina.

These coatings on corundum crystals, which have been observed frequently, are sometimes not thicker than a thick varnish, sometimes the whole crystal has been altered, leaving not even a core of the original mineral.

k. I have above alluded to the kidney-shaped and irregular masses from Gainesville, Hall County, Georgia, which consist of a nucleus of

corundum completely surrounded by margarite, and also by an earthy mineral with veins of foliated margarite through it. The margarite in contact with the grayish-white or pinkish corundum, is sometimes cryptocrystalline, pseudofibrous, but generally in aggregates of small pearly-white scales, of which I have made an analysis (*k*1). In the yellowish flesh colored mineral, the margarite is found in small veins consisting of pearly greenish-white scales, much resembling talc. My analysis (*k* 2) proved them to be margarite.

l. A beautiful white variety of broadly laminated margarite completely enveloping masses of cleavable corundum, has lately been discovered at Dudleyville, Alabama. The laminæ are sometimes two inches broad. I have analyzed it with the results given under *l*. This margarite appears to change into a bronze-colored or brownish-yellow mineral, of which I shall give a description below.

The following are the results of the analyses :

		*a*1.	*a*2.	*b*.	*c*.
Sp. Gr.	=	3.012	——		
SiO_2		32.19	33.46	30.70	31.48
Al_2O_3		49.62	——	49.33	49.01
FeO		0.91	——	0.39	0.52
MgO		0.41	——	0.76	0.54
CaO		7.81	7.05	11.86	10.70
Li_2O		trace.	——	0.36	
Na_2O		4.78	4.41	0.96	1.34
K_2O		0.57	1.02	0.65	
Ignition		3.93	4.94	5.91	3.94
Corundum		——	——	——	2.00
		100.22		100.92	99.54

		d.	*e*.	*g*1.	*g*2.	*h*1.
Sp. Gr.	=	3.047	3.00	——	3.087	2.990
SiO_2		30.45	31.29	28.11	28.80	29.34
Al_2O_3		50.86	47.24	49.16	49.57	48.73
FeO		0.42	0.85	0.43	0.34	0.78
MgO		0.37	0.88	0.45	0.75	0.78
CaO		12.13	10.86	11.08	11.33	11.32
Li_2O		trace.	trace.	0.45	not det'd.	trace.
Na_2O		1.72	2.66	0.67	"	2.61
K_2O		0.25	0.24	0.22	"	0.10
Ignition		4.48	5.92	6.43	6.64	6.55
Corundum		trace.	——	3.31	——	——
		100.68	99.94	100.31		100.21

		h2.	h3.	h1.	h2.	l.
Sp. Gr.	=	3.055	3.064	——	3.004	3.085
SiO_2		30.72	29.63	33.21	32.15	28.71
Al_2O_3		49.83	51.19	48.55	49.28	52.44
Cr_2O_3		——	0.13	——	——	——
FeO		0.84	0.59	0.46	0.57	0.39
MgO		0.76	1.09	0.39	0.63	0.74
CaO		10.84	11.28	10.04	11.09	11.52
Li_2O		trace.	——	trace.	trace.	0.38
Na_2O		2.19	1.22	1.64	1.18	0.67
K_2O		0.26	0.20	1.39	1.04	0.20
Ignition		6.21	4.73	4.59	4.16	5.40
Corundum		——	——	trace.	——	——
		101.65	100.06	100.27	100.14	100.45

It will be observed that in some of the margarites a considerable quantity of alcalies (R_2O), especially soda, replaces lime. This is especially the case with *a*1, in which one-third, and *e* and *h*1 and 2, in which about one-sixth of the lime is thus replaced.

Although many of these analyses were made only for the purpose of determining the species—in general they agree well with the established oxygen ratio for $RO : R_2O_3 : SiO_2 : H_2O = 1 : 6 : 4 : 1$.

Some contain a larger quantity of water.

I must not omit to notice here the description of a very important specimen which J. L. Smith (*l. c.*) gives in his memoir on emery: *A nodule, containing emery in the centre, with two concentric layers, the inner of chloritoid, the outer of emerylite (margarite).* In other words a pseudomorph of chloritoid and margarite after corundum!

28. Earthy Mineral from Gainesville, Georgia.

Associated with and forming the matrix of some of the Gainesville margarite and resulting, like the latter, from the alteration of corundum is an earthy mineral, of which I have made an analysis. Its structure is finely granular; it is soft, but contains some hard particles which appear to be quartz. Its color is between isabel-yellow and flesh-color. Very minute particles of margarite are intermixed with it.

Sp. Gr. = 2.851.

Quartz	=	2.17			
SiO_2	=	28.84	contains oxygen	15.38	
Al_2O_3	=	39.65		18.48	19.12
Fe_2O_3	=	2.13		0.64	
MgO	=	1.26		0.50	5.10
CaO	=	14.75		4.21	
Na_2O	=	0.48		0.12	
K_2O	=	1.60		0.27	
Ignition	=	10.41		9.25	
		101.28			

The oxygen ratio of RO : R_2O_3 : SiO_2 : H_2O = 1 : 3.75 : 3.01 : 1.8, or very nearly 4 · 15 : 12 : 7, which gives the formula :

$$2\,(2\,RO,\,SiO_2) + (5\,R_2O_3,\,4\,SiO_2) + 7\,H_2O.$$

Although the material was not quite pure, containing a very minute quantity of margarite, I wish to put this analysis on record, believing the mineral to be new, and wishing that it may be found in a state of greater purity.

29. Dudleyite (a new species).

At the Cullakenee Mine, but in larger quantity with the margarite of Dudleyville, Alabama, a soft bronze or brownish-yellow mineral is found, which is probably the result of the alteration of margarite and still retains its form ; lustre pearly. When heated, it exfoliates very slightly and then melts with difficulty into a brownish-yellow plebby mass.

With chlorhydric acid decomposed easily with separation of silicic acid in pearly scales. It is named after the locality, Dudleyville, Alabama.

The analysis gave :

SiO_2	=	32.42	contains oxygen 17.29	
Al_2O_3		28.42	13.24	14.74
Fe_2O_3		4.99	1.50	
FeO		1.72	0.38	
MgO		16.87	6.75	
Li_2O		0.19	0.10	7.71
Na_2O		1.52	0.39	
K_2O		0.56	0.09	
Ignition		13.43	11.94	
		100.12		

The oxygen ratio for RO : R_2O_3 : SiO_2 : H_2O is = 1 : 1.91 : 2.24 : 1.55, which is very near 6 : 12 : 14 : 10, giving the formula :

$$2\,(3\,RO,\,2\,SiO_2) + (4\,R_2O_3,\,3\,SiO_2) + 10\,H_2O.$$

30. Lazulite.

In mentioning the alteration of the corundum of Crowder's and Clubb's Mountains, Gaston County, North Carolina, I observed that in all these localites, and others which I considered as analogous, *lazulite* was one of the results of alteration.

I have seen specimens from the Gaston County localities which were mixtures of lazulite and damourite, and, what is very significant, lazulite, which inclosed crystals of rutile, the constant associate of the corundum at these localities.

Although not in accordance with the views of modern chemistry, I hope that I will be justified in having attempted to give the composition of these minerals in formulæ, which, as we once thought, would express an idea of the rational composition of the species. I do not intend to discuss their merits, I will even admit that such formulæ state a great

deal more than what with our knowledge of the subject, we have a right to express. Yet there are so many geologists and mineralogists, who have familiarized themselves with this mode of expression, that I thought it an injustice to them to give merely the empirical composition.

After having thus given the above data, the conclusions arrived at by this investigation are :

That, at the great period when the chromiferous chrysolite beds (in part subsequently altered into serpentine, etc.) were deposited, a large quantity of alumina was separated which formed beds of corundum ;

That, this corundum has subsequently been acted upon and thus been changed into various minerals, such as spinel, fibrolite, cyanite, and perhaps into some varieties of feldspar, also into tourmaline, damourite, chlorite and margarite ;

That, a part of the products of the alteration of corundum still exists in the form of large beds of mica-(damourite) and chlorite-slates or schists ;

That, another part has been farther altered and converted into other minerals and rocks, such as pyrophyllite, paragonite, beauxite, lazulite, etc.

The question has often been asked me, how I could explain these wonderful changes which have taken place with a substance so absolutely insoluble as corundum? My answer is that I know nothing about it. I have in this whole investigation carefully avoided making any statements which are not based upon undeniable facts; in a few instances only, where the facts were very strong in my favor, I have allowed myself to judge from analogy.

Mr. S. P. Sharpless is probably correct in his supposition that corundum has been altered into lesleyite and pattersonite by the action upon it of water containing alcaline silicates. Such a view is very plausible, especially if we add an elevated temperature and great pressure. I have tried a number of experiments in this direction. I have put corundum reduced to an impalpable powder, and subsequently boiled out with chlorhydric acid and washed with water, into a glass tube with a solution of potassic silicate, and after sealing it have exposed it to a temperature, which was gradually increased to about 250° C. With one exception, all my tubes burst before the alcaline silicate had time to act upon the corundum. In this one case the tube stood for about three days and nights, before it exploded. The scales of the mineral substance, which came from the tube were carefully collected, washed out and then treated with dilute chlorhydric acid and evaporated to dryness, the residue moistened with chlorhydric acid, the mass extracted by water. The clear liquid gave with ammoniac hydrate a trace of a flocculent precipitate, which appeared to be alumina. The quantity was too small, however, to place any value upon this experiment. It may be well to mention in this connection that under pressure and reduced to a fine powder, corundum dis-

solves with considerable facility in dilute sulphuric acid, as I have already stated above.

I hope that the time may soon arrive when we shall have a clear insight into the alterations of corundum, which I have above described. At present we have no facts upon which a tenable theory could be built.

And this finishes my task. I have devoted to it my leisure hours for over two years. Nobody can be more aware of the many imperfections of this investigation, but I hope that it will be taken into consideration that I have labored under very great disadvantages. I had for consultation neither a collection to compare my specimens with those from other parts of the world, nor a library of sufficient completeness. All that I have done, I have done with my own labor and the assistance of many kind friends, to whom I am under great obligations; of the many who helped with specimens, etc., I will especially mention Rev. Dr. E. R. Beadle, Prof. G. J. Brush, Dr. Isaac Lea, Dr. Joseph Leidy, Rev. C. D. Smith, of Franklin, North Carolina; Prof. E. A. Smith, of Tuscaloosa, Alabama, and Col. Joseph Willcox; the greatest gratitude I owe to my assistants, Dr. Geo. A. Koenig and Thos. M. Chatard, S. B., for the many valuable analyses which they made, and which alone have enabled me to finish this work in this comparatively short time.

University of Pennsylvania, August 18, 1873.

Postscript.

Since writing the above, an article has appeared in the September number of the American Journal of Science and Arts, entitled "Notes on the Corundum of North Carolina, etc., by J. Lawrence Smith, Louisville, Kentucky," which contains analyses of a few species, discussed in my paper.

There are a few points to which I wish to call attention.

Under "*zoisite*," Dr. Smith gives analyses of two minerals, which, in my opinion, do not belong to this species. The "*light green*," analyzed by Tho. M. Chatard and described as Smaragdite(?) (Kokscharoffite), is probably an aluminous hornblende (?), the black variety is evidently the same mineral, containing, however, as proved by Dr. Smith's analysis, a part of the alumina replaced by ferric oxide. The zoisite from Cullakenee is *always white* with only a *slight grayish* or *greenish tint*.

The granular "*andesite*" gives, according to his analysis, the oxygen ratio 0.85 : 3 : 9.09, which is very near = 1 : 3 : 9, placing this mineral, like that from Chester, Massachusetts, under *oligoclase*.

Philadelphia, August 28, 1873.

CONTRIBUTIONS TO A KNOWLEDGE OF THE CURCULIONIDÆ OF THE UNITED STATES.

By George H. Horn, M. D.

(*Read before the American Philosophical Society, September* 19, 1873.)

The following pages have been prepared as a beginning of the systematic study of the *species* of Curculionidæ inhabiting our country. It is to be regretted that this family has been almost entirely neglected by our students, so much so, in fact, that the large majority of the species have been described abroad, and, with the exception of several genera revised by Dr. Leconte, no genus has ever been studied as a whole by American students. It is hoped that the present essay may show that the study of this family is by no means as difficult as has been supposed. The field being almost entirely new, numerous opportunities are afforded for research, and without doubt characters remain to be developed having an important bearing in the systematic arrangement of the family.

One character is mentioned in the following pages that appears to have escaped notice. In most if not all the genera of *Mecorhynques*, the males have eight and the females seven dorsal abdominal segments. The *Calandrides* and *Cossonides* appear not to possess this character, as also all the *Brachyrhynques* which I have had time to examine.

The synonymy of our *Curculionidæ* is at times troublesome to unravel, and many species have been described from slight varieties. On the other hand, many are unnamed, and it is probable that number of species at present given in catalogues is not far behind the total, as the unnamed species will about fill the blanks caused by the correction of synonymy.

All of the genera in the following pages have become familiar to students in an empirical manner, consequently little is said concerning the genera themselves, this work being left to the continuation of the "Classification of the Coleoptera of North America," which will doubtless soon appear, from the hands of Dr. Leconte.

The first part of the present essay contains the *Calandrides* and *Cossonides* forming the entire representation of the genera and species of Phalanx 11, Cohort II., Legion II., according to the system of Lacordaire, which occur in our fauna. The remaining pages are devoted to such isolated genera as appear to stand in need of elucidation.

CALANDRIDES.

The tribe Calandrides is divided by Lacordaire into six groups, of which three only have representatives within our faunal limits.

Metathoracic episterna very broad, epimera large..... RHYNCHOPHORIDES.

Mesothoracic epimera acute above, ascending..... Rhynchophorus.

Metathoracic episterna moderate.

Mesothoracic epimera truncate above.....	SPHENOPHORIDES.
Spongy portion of antennal club retracted, that is, visible at the tip only. Prosternum narrow.....	SCYPHOPHORUS.
Spongy portion of club large, occupying at least a third of the tip.	
Anterior coxæ widely separated, prosternum between the coxæ as wide as the diameter of a coxal cavity..	METAMASIUS.
Anterior coxæ approximate, prosternum linear.....	RHYNCHOPHORUS.
Mesothoracic epimera acute above.....	CALANDRIDES.
Prosternum widely separating the coxæ	CALANDRA.

RHYNCHOPHORUS Herbst.

R. cruentatus Fab. Syst. Ent., p. 128; Herbst, Coleop. 6, pl. 61, fig. 2; Oliv. Ent. V., 83, p. 82, pl. 12, fig. 147; *Zimmermanni* Fahrs. Schönh. Gen. Curc. viii., pt. 2, p. 219.

Above sub-depressed, sub-opaque, velvety, color variable. Rostrum longer than half the thorax, apical portion sparsely punctured, at base roughly punctured. Thorax one-fourth longer than wide, elliptical, apex suddenly constricted, sides feebly, base more decidedly arcuate, surface sparsely and minutely punctulate. Scutellum elongate, feebly elevated along the middle, attenuate at apex. Elytra conjointly emarginate, humeral angles broadly rounded, sides feebly convergent behind, apices truncate, surface nine striate, outer four striæ feebly impressed, inner five deep, at bottom punctured, inner intervals feebly convex, outer flat. Pygidium sparsely and coarsely punctured, more densely at apex. Body beneath shining, sparsely and very minutely punctulate. Last ventral segment at the latero-dorsal region, coarsely punctured and with a line of yellowish hairs. Anterior tibiæ densely fimbriate with long yellowish hairs, middle and hind tibiæ less fimbriate, femora beneath fimbriate. Anterior tibiæ within mucronate at apex, externally bidentate, middle and hind tibiæ broadly rounded at tip, mucronate within. Tarsi with the third joint moderately dilated and densely pilose along the anterior margin. Length .8–1.0 inch; 20–25 mm.

Var. *Zimmermanni*, Fah. Body above and beneath totally black.

Var. *cruentatus*, Fab. Thorax red, sides broadly margined with black, and a median black stripe, elytra black with red spots. Body beneath piceous, legs and abdomen paler.

Var. ———. Body above in great part red, lateral black spaces of thorax wanting, median stripe more or less divided, elytra in great part red with black spots of varying number and size. Pectus black, abdomen and legs red.

The above varieties run together by very gradual changes of color. Although the term "red" is used, the color is not properly red, but a dark velvety crimson, which, however, also varies in shade.

Fabricius' name appears to have been lost sight of entirely by the authors of Gen. Curc., notwithstanding the very fair figures (exaggerated in color) given by both Herbst and Olivier.

Occurs from South Carolina to Louisiana.

SCYPHOPHORUS Schönh.

Antennal club with spongy space retracted, visible only at the tip. Anterior tibæ bidentate externally at tip, middle and hind tibiæ with the outer angle bispinous. Third joint of all the base broadly dilated fimbriate beneath along the anterior margin.

The species in our fauna are as follows:

Thorax sparsely punctured, punctures of the disc much finer.
  Elytral intervals feebly convex, irregularly biseriately punctulate..... ..... acupunctatus.
Thorax very coarsely and deeply punctured.
  Elytral intervals flat, irregularly biseriately punctulate robustior.
  Elytral intervals flat, with a single series of coarse punctures..... Yuccæ.

S. acupunctatus Gyll. Schön. Gen. Curc. IV., p. 857; *asperulus* Lec. Pacif. R. Rep. 1857, p. 58.

Black, shining, feebly convex above. Rostrum three-fourths the length of thorax, sparsely and finely punctured at the sides, more coarsely punctured at base. Thorax longer than wide, anteriorly moderately constricted, base broadly arcuate, sides in front strongly arcuate and rapidly widening, at middle feebly arcuate and very slightly narrowing to base; surface sparsely and finely punctured, punctures at sides coarser and sub-muricate. Scutellum slightly impressed. Elytra not wider than thorax and but one-fourth longer, surface striate, striæ coarsely but not closely punctured, intervals moderately convex. finely biseriately irregularly punctulate. Pygidium sparsely punctured at base, more densely and very coarsely at base. Body beneath coarsely punctured. Tibiæ sparsely fimbriate within, femora coarsely punctured beneath, each puncture bearing a tuft of short, yellow, stiff hairs. Length .40–.50 inch; 10–13 mm.

Occurs from Mexico to California.

S. interstitialis Gyll., Cuba, is very closely allied to the preceding.

S. robustior n. sp.

Black, sub-opaque, Rostrum three-fourths the length of thorax, at sides minutely punctulate, at sides of base coarsely punctured. Thorax moderately convex, apex constricted, sides arcuate in front, becoming gradually broader, at middle and to base sub-parallel, base feebly arcuate, disc coarsely but sparsely punctured, punctures denser, coarser, and deeper at the sides. Scutellum sulcate. Elytra convex, opaque, striate, striæ coarsely and rather closely punctured, intervals feebly convex,

finely and irregularly biseriately punctulate. Pygidium sparsely punctured, at base finely, at apex coarsely and deeply. Body beneath coarsely foveato-punctate. Legs as in *acupunctatus*. Length .50 inch ; 13 mm.

Closely allied to *acupunctatus*, but opaque, and with the thorax very much more coarsely punctured. Its form is also more robust.

One specimen in Cab. Leconte, from.

S. Yuccæ, n. sp.

Black, sub-opaque, depressed. Rostrum nearly as long as thorax, coarsely and deeply punctured at base and gradually more finely to apex. Thorax nearly as broad as long, apex constricted, thence becoming rapidly broader, sides feebly arcuate, at base slightly broader, surface very coarsely punctured, punctures slightly more dense at the sides. Elytra deeply striate, striæ not conspicuously punctured, intervals flat with a single series of moderately coarse, rather closely placed punctures. Scutellum not channelled. Pygidium at basal fourth finely punctured, the remainder coarsely and very deeply punctured. Body beneath more shining than above, coarsely, deeply, and rather closely punctured. Femora coarsely and submuricately punctured. Length .40–.64 inch ; 10–16 mm.

Male. Anterior tibia sub-dentate at basal fourth, densely pubescent on inner side, middle and hind tibiæ sparsely pubescent, and at basal fourth a short, broad, obtuse tooth.

Female. Tibiæ not dentate within, sparsely fimbriate.

Differs abundantly from any described species by its more depressed form and the interstitial punctuation.

Occurs in the southern portion of California, and feeds on the Yucca gloriosa, on which plant it is found in the spring, at the base of the flower stalk. Specimens were collected by Mr. Wm. M. Gabb, others have been sent by Mr. Jas. Behrens, collected at San Diego.

METAMASIUS, n. g.

The above name is suggested for various species at present retained in Sphenophorus, differing only in the very widely separated anterior coxæ. The prosternum is as wide, or nearly so, as the diameter of one of the coxal cavities. The third tarsal joint is broad and densely pubescent beneath as in the first group of the following genus.

One species occurs in our fauna, although many others probably belong to the genus, among them *Sphen. carbonarius*, Chevr., from Mexico.

M. sericeus Latr. Humb. et Bonp. Voy. I., p. 206, pl. 22, fig. 4; Oliv. Ent. V., 83, p. 84, pl. 28, fig. 409 ; Gyll. Schön. Gen. Curc. IV., p. 896.

Elongate, feebly convex, opaque. Rostrum rufous, longer than half the thorax, finely punctured at the sides, more evidently punctured at base ; above finely channeled at base and a puncture between the eyes. Thorax red, subopaque, at sides a short black stripe ; at middle an entire broad line, and at base, on each side of middle, a triangular spot black,

surface sparsely punctured at the sides; one-fourth longer than wide, apex moderately constricted, base feebly arcuate, sides in front gradually arcuate to middle, and then nearly parallel to base. Scutellum not sulcate. Elytra at base as wide as thorax, at humeral protuberance broader, thence gradually narrower, apices rounded, surface striate, striæ punctured, intervals flat, impunctured. Pygidium at base finely punctured, surface sericeous, sparsely pubescent, at apex opaque, sparsely punctured, each puncture bearing a spiniform yellowish hair, and on each side of the tip a tuft of yellowish hairs. Body beneath shining, sparsely and finely punctured, red variegated with black. Legs red, knees tipped with black. Length .44 inch; 11 mm.

The elytra are in great part black, the base being occupied by a broad red space, broader at middle; the sutural interspace is black. The apical black space may also become spotted with red.

The description of this species by Gyllenhal is very characteristic, and corresponds exactly with a specimen in my cabinet from California; another in the cabinet of Dr. Leconte, from an unknown locality, reproduces the figure of Olivier, and, although differing in details of color, is undoubtedly identical.

One specimen from the Southern Coast Range of California, collected by Mr. Wm. M. Gabb.

SPHENOPHORUS Schönh.

This genus contains many species in our fauna which have been unnecessarily multiplied by the failure of the older authors to recognize the extent of specific variation. The characters given in the generic table are sufficient to make the genus readily known. The tibiæ vary in form, and the tarsi in form and vestiture, and afford the readiest as well as most natural method of dividing the genus into groups. Many of the species have their surface coated so that the sculpture is partially concealed. The coating appears to be of two kinds; first a *natural coat*, equally distributed above and beneath, of dense structure, and of smooth shining surface, always allowing the punctures, even the most minute to be visible; second, an *accidental coat*, which covers, usually, only the upper surface of the body and the legs, composed of argillaceous material hardened, probably, by mixture with some exudation from the surface, and which almost entirely obliterates all sculpture excepting prominent elevations. The following are the groups into which it is proposed to divide the genus:

Anterior tibiæ with the outer apical angle prolonged, middle and hind tibiæ truncate. Tarsi slender..... GROUP I.

Tibiæ all broadly rounded at outer apical angle.

Third joint of all the tarsi broadly dilated,

Spongy pubescent over its entire surface beneath..... GROUP II.

Broadly glabrous at middle..... GROUP III.

Third joint of hind tarsi conical. (In some species slightly dilated, but then simply fimbriate at the sides, and not spongy pubescent.)

Third joint of anterior and middle tarsi feebly dilated and spongy pubescent at the sides..... GROUP IV.
Third joint of anterior and middle tarsi not dilated, and simply pilose at the sides or entirely glabrous..... GROUP V.

Group III. contains all the species in our fauna with the natural glabrous coat, in the other groups (except Group I.) there are species with the accidental coat or entirely glabrous.

Group I.

Anterior tibiæ with the outer angle prolonged, middle and hind tibiæ truncate at tip. Tarsi slender, third joint fimbriate at margin.

The following species form this group:

Thorax without well-defined callosities, surface punctured.
Discal striæ of elytra not distinctly punctured, intervals very minutely punctulate..... simplex.
Discal striæ punctured, intervals very conspicuously punctured.
Intervals unequal, alternately uni- and bi-seriately punctured..... vomerinus.
Intervals equal uniseriately punctured.....var. *baridioides.*
Striæ fine, impunctured, interrupted by large shallow foveæ..... Ulkei.
Thorax with distinct elevated smooth spaces, intervals very coarsely punctured or eroded.
Striæ with moderately coarse punctures distantly placed inæqualis.

S. simplex Lec. Proc. Acad., 1859, p. 70.

Moderately elongate, black, feebly shining. Rostrum three-fourths as long as thorax, filiform, sparsely punctured, at base feebly sulcate, and between the eyes slightly transversely impressed. Thorax oblong, suddenly constricted at apex, sides feebly arcuate, surface moderately convex, sparsely punctured over the entire surface, punctures coarser behind, especially in a very feeble impression in front of scutellum. Scutellum broadly grooved. Elytra slightly narrower behind, sub-opaque, deeply striate, inner six striæ impunctured, outer three coarsely punctured except at apical fourth, intervals flat subequal, alternate bi- and uni-seriately finely punctulate. Pygidium moderately coarsely punctured, each puncture with a short seta and with a tuft of hairs on each side, tip strongly inflexed and smoother. Body beneath sparsely punctured. Length .28–.32 inch; 7–8 mm.

Male. Tibiæ fimbriate with long yellowish hairs within, anterior and middle with the inner edge strongly sinuous, hind tibiæ strongly sub-angulate.

Female. Tibiæ less fimbriate and feebly sinuous within. The hairs of the tibiæ are especially long at the sub-angulation. The sub-apical spur is very small.

Occurs in California at Tejon and Fort Yuma.

S. vomerinus Lec. Proc. Acad., 1858, p. 81.

Black, sub-opaque or very feebly shining. Rostrum slightly longer than half the thorax, moderately robust, compressed, upper edge sparsely punctured at base, very finely grooved and with an impressed puncture between the eyes. Thorax longer than wide, somewhat variable in form, usually oblong rarely sub-quadrate, sides very feebly, base less arcuate, surface equally punctured over the entire surface, rarely with an obsolete smooth median space, punctures coarser at the sides and base, and also more dense before the scutellum. Scutellum smooth, not channeled. Elytra broadest slightly behind the base, and gradually narrower to apex, surface deeply striate, striæ distantly punctured, intervals flat, sub-equal, sometimes alternating and coarsely uni- or bi-seriately punctured. Pygidium coarsely and at apex sub-confluently punctured. Body beneath sparsely punctured. Length .24–.36 inch ; 6–9 mm.

Var *baridioides*. Elytral intervals sub-equal, uni-seriately punctured.

The sexes do not differ remarkably. The tibiæ are very sparsely fimbriate within and the anterior are feebly sinuate. The sub-apical spur is moderate.

The elytral intervals vary in the degree of punctuation and also in width. In the typical form the intervals are slightly alternately broader, and the narrower space distinctly uni-seriately punctulate, and the broader intervals bi-seriately or even confusedly punctured. In the variety *baridioides* the intervals are equal and uni-seriately punctulate with coarser punctures than in the preceding variety. These latter seem almost entitled to rank as distinct species, but every necessary link between the two forms exists. The legs are sometimes rufous.

Colorado, Arizona, and California east of the Sierras.

S. Ulkei, n. sp.

Black, shining, form and aspect of *placidus*. Rostrum longer than half the thorax, moderately arcuate, compressed, surface moderately punctured, at base a fine channel terminating in a moderately deep foveæ between the eyes. Thorax longer than wide, anteriorly moderately constricted, sides in front rather strongly arcuate, behind the middle feebly arcuate and narrowed to base, surface moderately convex, without vittæ but with a slight impression at middle, behind the anterior constriction (as in *placidus*), and a V-shaped impression behind, more coarsely punctured, the remainder of the surface sparsely and finely punctured becoming more dense toward the sides and coarse at the basal angles. Scutellum feebly concave. Elytra oval, sides feebly arcuate and slightly narrowed toward the tip, surface finely striate, striæ not punctured but interrupted by large shallow foveæ moderately approximated ; intervals slightly unequal, the sutural, 2–4–6–8 bi-seriately finely punctulate at base, gradually becoming uni-seriate at apex, narrower intervals uni-seriately punctulate. Pygidium coarsely and deeply punctured, apex and base more finely and the former more densely punctulate.

Body beneath sparsely and moderately finely punctured. Last ventral segment with a small fovea made up of coarse confluent punctures. Anterior tibiæ with the outer apical angle prolonged, middle and hind tibiæ truncate. Length .32 inch ; 8 mm.

Occurs in Nebraska, Colorado, New Mexico, Wyoming.

S. inæqualis Say. Curc. p. 23 ; Am. Ent. edit. Lec. I., p. 291 ; *contractus* Gyll., Schönh., Curc. IV., p. 953.

Form robust, color black, upper surface with luteous acquired coat. Rostrum three-fourths as long as thorax, slightly compressed, sparsely punctured at base, finely canaliculate and with a slight fovea between the eyes. Thorax constricted in front, longer than wide, oval, base less arcuate, surface coarsely foveato-punctate with normally five smoother spaces, one median entire line dilated in front of middle to a rhomboid spot, two irregular sub-basal and two sub-apical spaces which may unite in a sinuous line. Scutellum broadly channeled. Elytra scarcely longer than the head and thorax, widest behind the base, rapidly narrowing to apex, surface striate, striæ with coarse, very distant punctures, intervals flat, undulating, closely and coarsely punctured ; humeral prominence and a slight tuberosity at the apex of the intervals 5–6–7 more shining. Pygidium coarsely and densely punctured at apex. Body beneath black, shining, coarsely but sparsely punctate. Tarsi piceous. Length .24 inch ; 6 mm.

Occurs in the Gulf States.

Group II.

The species of this group are few in number in our fauna, and are thus distinguished :

Body above red, with black spots varying in size and color... 13-punctatus
Body above brownish, or piceous, irrorate..... pustulosus
Body above entirely black, sub-opaque..... validus

S. tredecimpunctatus Illig. Schneid. Magaz. V., p. 613 ; Hbst. Käf. VI., p. 10, pl. 60, fig. 5 ; Gyll. Schönh. IV., p. 898 ; *cribarius*, Fab. Oliv. Ent., V. 83, p. 88, pl. 28, fig. 112, b ; *quinquepunctatus*, Say. Am. Ent., edit. Lec., p. 19, pl. 9 ; *variabilis*, Gyll. loc. cit., p. 899 ; *anceps*, Gyll. loc. cit., p. 894.

Many other synonyms are recognized in the catalogues, and many more will doubtless be added after a little examination, but these are all which have been made upon specimens from our fauna, and it is unnecessary to mention others from Mexico southward.

Body beneath black, pruinose, above red with black spots, five on the thorax, and four on each elytron, arranged as follows : thorax with a median elongate oval spot, two at the base, touching the margin or distant from it, two spots anteriorly forming a quadrangle with the basal spots, elytral spots four on each, one behind the humeral prominence, two median arranged transversely, one sub-apical, more or less trans-

verse. The elytral spots have a tendency to become confluent, and specimens occur with the entire surface black, margined at the sides with red. Rostrum black, longer than half the thorax, sparsely punctured, and finely grooved at base. Thorax longer than wide, apex constricted, sides in front strongly arcuate, behind sub-parallel, surface sparsely punctured. Scutellum feebly grooved. Elytra finely striate, striæ finely and distantly punctured, intervals flat, impunctured. Pygidium perforato-punctate at apex, more finely and densely punctured at base. Body beneath sparsely punctured. Length .28–.40 inch; 7–10 mm.

In well preserved specimens the upper surface is slightly pruinose.

Occurs over our entire country, from the Atlantic to the Pacific, and southward through Mexico.

S. pustulosus Gyll. Schönh. Curc. IV., p. 923.

Body beneath black with luteous, sub-sericeous efflorescence. Rostrum three-fourths the length of thorax, sparsely punctulate at base, slightly canaliculate, punctured, each puncture surrounded with luteous efflorescence. Thorax longer than wide, anteriorly slightly constricted, sides feebly arcuate, gradually divergent to base; surface brownish, at sides darker, opaque, surface sparsely punctured, each puncture with luteous area. Elytra slightly narrower to apex, surface brownish, opaque finely striate, striæ distantly punctured, intervals flat, distantly uni-seriately punctulate, punctures of striæ and intervals with luteous area. Scutellum luteous. Pygidium very coarsely perforato-punctate at sides and apex. Body beneath sparsely punctate. Length .40–.44 inch; 10–11 mm.

The punctures of the surface being surrounded by a round luteous area, gives the aspect of a very coarse punctuation.

Occurs in Arizona.

S. validus Lec. Proc. Acad. 1858, p. 80; *procerus*, Lec. loc. cit.

Black, sub-opaque, or with a slight velutinous aspect. Rostrum nearly as long as thorax, strongly arcuate at tip, finely punctured, a puncture at base between the eyes. Thorax sub-depressed, apex feebly constricted, sides moderately arcuate, gradually diverging and at basal fourth, sub-parallel; surface very sparsely and finely punctulate. Elytra rapidly broader behind the base, then gradually narrowed to tip, basal margin slightly reflexed, surface finely striate, striæ distantly and obsoletely punctulate, intervals flat, very minutely punctulate. Pygidium coarsely perforato-punctate and slightly more convex along the median line. Body beneath black, sub-opaque, sparsely punctured, abdomen more coarsely punctured. Length .60–.90 inch; 15–23 mm.

Male.—Anterior tibiæ densely fimbriate within with long-yellowish hairs, middle tibiæ fimbriate with shorter hairs, hind tibiæ with very short black hairs.

Female.—Tibiæ within fimbriate, with short hairs.

This species is the largest Sphenophoride in our fauna. I find specimens from Mexico labelled *fuliginosus* Chev., but no such species is

known to me, nor do I find any description of a similar species. It may however be described, and I quote the name that the synonymy may be determined.*

Occurs in Sonora, southern California and Mexico.

Group III.

This group contains species of moderately large size, all characterized by the presence of a *natural* glabrous coating, which may be more or less removed by abrasion, and is sometimes almost entirely lost on the upper surface, but always exists beneath. The third tarsal joint, of all the feet, is dilated and densely pubescent beneath, excepting a median space.

The species are as follows:

Body above densely clothed with a glabrous *natural* coat, disc of thorax flattened, three vittæ distinctly indicated. Abdomen ♂ sparsely hairy along the middle.....ochreus.

Body above almost entirely denuded. Abdomen ♂ glabrous....

Striæ of elytra coarsely punctured.....discolor.

Striæ finely and distantly punctured..... pictus.

These species are exactly similar in form, and very closely allied.

S. ochreus Lec. Proc. Acad. 1858, p. 80; *? æqualis*, Gyll. Schönh. Curc. IV., p. 941.

Body black, entirely covered with a *natural* glabrous coat, varying in color from pale ochreous to plumbeous. Rostrum as long as three-fourths of the thorax, compressed, slightly broader at tip, sparsely punctured, at base very finely grooved, between the eyes a moderately deep impression. Thorax longer than wide, apex slightly constricted, anteriorly rapidly broader to apical fourth, sides thence sub-parallel, base feebly bisinuate; disc sub-depressed, with three entire vittæ indicated, surface sparsely and coarsely punctured between the vittæ, punctures coarser at base, vittæ minutely punctulate very rarely denuded. Scutellum sub-sulcate. Elytra slightly broader behind the base gradually narrowed to tip, surface finely striate, striæ moderately, coarsely punctured, intervals flat, alternately broader, the broader intervals bi- or tri-seriately punctulate, the narrow uniseriately, and with coarser punctures, the broader intervals frequently darker in color. Pygidium coarsely punctured and with a slight tuft of hairs at each side of the tip. Body beneath and legs sparsely punctured and coated. Length .44–.68 inch; 11–17 mm.

Male.—Metasternum and abdomen broadly concave, the latter sparsely villous along the middle. Femora beneath, and tibiæ within sparsely fimbriate with yellowish hairs.

Female.—Abdomen convex, not villous, legs less fimbriate.

This species varies as above indicated in the color of its glabrous coat, from pale ochreous to plumbeous and cinereous. The type specimen does

* I have since been informed by M. Aug. Sallé, that this is merely a Catalogue name.

not differ notably from the specimens from this side of the Mississippi, except that the summits of the thoracic vittæ have become denuded.

Occurs from Canada to Arizona. It is possible that this is the species described by Gyllenhal as *æqualis*, and if so it has evidently been placed in the wrong *Strips*, and should my surmise prove correct, this name has priority, and must be used in place of *ochreus*.

S. discolor Mann. Bull. Mosc. 1843, II., p. 293; Schönh. Gen. Curc. VIII., 2, p. 246.

Closely allied to *ochreus*, differing as follows:

Thorax regularly convex, vittæ scarcely indicated, surface denuded, except a narrow space at the sides, sparsely punctured, punctures at the median basal region coarser and denser. Elytra almost entirely denuded, rarely with the narrower intervals coated, striæ moderately deep, coarsely and rather closely punctured. Body beneath entirely coated. Length .48–.64 inch; 12–16 mm.

Male.—Abdomen longitudinally concave, not villous.

Female.—As in *ochreus*.

S. pictus Lec. Proc. Acad. 1858, p. 80.

Thorax coated, vittæ distinctly limited by punctures, and deprived of coat, surface sparsely punctured, over the entire surface, and not denser at base. Elytra entirely denuded except the entire second, the fourth and sixth at base and the lateral region. Pygidium sparsely and less coarsely punctured than in the two preceding species. Length .64 inch; .16 mm.

Sexual characters as in *ochreus*. The elytral striæ are fine, finely and distantly punctured, the intervals flat, punctulate with the tendency to alternation of puncturing almost obliterated.

One specimen, Vallecito, California.

One other character may be noted as separating these species from those of the next group, with which I suspect *ochreus*, has been confounded. The thoracic vittæ are entire, and the lateral does not send a branch from the outer side to the base.

Group IV.

The third joint of the anterior and middle tarsi are dilated and pubescent at the sides, the hind third tarsal joint is usually conical, very rarely feebly dilated, and at the sides sparsely fimbriate.

From the characters of the table, this group can only be confounded with the preceding, in the former, however, the natural glabrous coat is always present, here never. The lateral carina of the thorax at basal half is here always bifid, that is, sends a branch from its middle which attains the hind angle of the thorax. In the next group the tarsi are slender, and sparsely fimbriate, never pubescent at the sides.

Elytral intervals, either flat or alternately elevated, in their entire length; striæ moderately finely punctured.
Thoracic smooth lines unequal among themselves, and of varying width, sometimes obliterated.
Elytral intervals more or less convex, always alternating, striæ moderately deep..... pertinax.
Elytral intervals flat, equal, striæ fine..... robustus.
Thoracic smooth lines equal, parallel entire, strongly elevated.
Elytral intervals alternately sub-costiform.....costipennis.
Third interval strongly elevated at basal half, striæ coarsely punctate.
Rostrum normal at tip, median thoracic smooth space dilated in rhomboid at middle ..... cariosus.
Rostrum suddenly dilated at tip and obliquely truncate, median thoracic line entire and not dilated..... latinasus.

S. pertinax Oliv. V., 83, p. 90, pl. 28, fig. 417; Gyll. Schönh. Gen. Curc. IV., p. 938; Say. Am. Ent. edit. Lec. I., p. 288; *interstitialis*, *truncatus* Say. loc. cit; ? *canaliculatus* Boh. Sch. Gen. Curc. VIII. 2, p. 253.

This species is extremely variable in form and sculpture, but does not admit of further division than merely into varieties, which pass from one to another through every conceivable grade. The following is the description of the typical form.

Black, moderately shining beneath, sub-opaque above. Rostrum three-fourths the length of thorax, moderately compressed, scarcely broader at tip, surface very minutely, at base more evidently punctulate and above at base, with a slight channel, slightly broader and deeper posteriorly. Thorax longer than wide, apex constricted, base feebly bisinuate, sides strongly arcuate in front, sub-parallel at basal half; surface with three entire elevated smooth lines, the middle nearly entire, beginning at apex in a moderately fine line, rapidly widening; at a point in front of middle suddenly narrowed, and from thence to apex continued by a line broadest in front, gradually narrowing to base, and at tip confused by the basal punctures; lateral vittæ entire, beginning at the apical constriction and ending at the basal margin, inner edge sinuous opposite the dilatation of the median vitta, at which point a lateral branch is given off, usually slender and attaining the basal angle, the portion of the lateral vitta posterior to this branch is always broader; space between the vittæ and to the sides, coarsely punctured and more or less filled with luteous coating. Scutellum not sulcate. Elytra at base conjointly feebly emarginate, broader at humeri and arcuately narrower towards apex, which is feebly rounded or subtruncate, surface striate, striæ inconspicuously punctate, intervals feebly alternating in width and convexity, the broader and more convex denuded, the others with luteous coating, surface (when denuded) very minutely punctulate. Pygidium sparsely and

rather coarsely punctured, near apex sparsely clothed with short bristly hairs forming a tuft on each side of apex. Body beneath coarsely but sparsely punctate at the sides, at middle comparatively smooth. Legs black, finely punctulate. Length .48–.56 inch ; 12–14 mm.

Var. *interstitialis* Say. Form more robust. Thoracic vittæ scarcely elevated, the median gradually broader to middle, then gradually tapering to base, forming an elongate fusiform space, the intervals between the vittæ more densely punctured. Striæ of elytra distinctly punctured, intervals feebly alternating in width but scarcely in convexity, the broader biseriately, the narrower uniseriately punctured. Body beneath very coarsely punctured, the middle as coarsely punctured as the sides. Length .48–.56 inch ; 12–14 mm.

The punctures of the elytral striæ being more evident in this variety than in any other, together with the slight alternation of the intervals, gives the aspect of a double series of punctures of which Say speaks.

Occurs in the Southern States, and is injurious to the corn.

Var. *pertinax* Oliv. ; *truncatus* Say, is the form described as typical.

Occurs from the Middle States north and west.

Var. ——— ; *pertinax* ‡ Say. Thoracic vittæ less prominent than in *pertinax* Oliv. Elytral intervals sub-equal in width and convexity, and very minutely obsoletely punctulate ; striæ scarcely punctured.

Var. ———; the narrower intervals of the elytra are slightly irregular or eroded, so that an aspect of catenulation is produced.

Occurs in California.

Many other varieties might be enumerated, but these are deemed sufficient to cover the entire ground, so that any form differing from the typical descriptions may not be considered specifically distinct.

Occurs from Canada to Louisiana and from the Atlantic to the Pacific, and, unfortunately for farmers, not rare.

S. robustus n. sp.

Closely allied to *pertinax*, and differs as follows :

Median thoracic vitta feebly dilated at middle, posterior portion broad and attaining the base, lateral vittæ slightly sinuous internally, gradually wider from apex to base, lateral branch feeble. Elytra finely striate, outer three striæ distinctly, inner obsoletely and distantly punctured, intervals flat, sub-equal, alternately bi- and uni-seriately finely punctulate; surface evenly clothed with ochreous or plumbeous sub-sericeous exudation. Length .48–.56 inch ; 12–14 mm.

After the numerous variations of the preceding species which have been mentioned, it is with considerable diffidence that I venture to name the present form, but the aspect of the species is so distinct from that seen in any of the varieties of the preceding, and moreover I find no intermediate forms.

Occurs as widely as the preceding, but less common. A variety of this

form occurs with the thoracic vittæ almost entirely obliterated, the punctuation finer, and the elytra glabrous.

S. costipennis n. sp.

Black, shining, form similar to *pertinax* but more slender. Rostrum three-fourths as long as the thorax, strongly compressed and slightly broader at tip, at base slightly canaliculate and moderately punctured. Thorax with three rather strongly elevated entire parallel vittæ, the lateral with a branch from middle to basal angle, intervals coarsely punctured and with luteous coating. Elytra finely striate, striæ with distant, moderately coarse punctures, intervals alternately slightly broader, the broader intervals strongly convex, in their entire length minutely and irregularly biseriately punctate, narrower intervals usually with luteous coating, uniseriately punctate. Pygidium sparsely punctate, punctures near apex submuricate and bearing a short hair, a tuft of hair on each side of apex. Body beneath sparsely punctate. Length .40 inch ; 10 mm.

A variety occurs with the upper surface red, with the sutural interval and the median thoracic vitta black. The under surface is red varied with black, and the legs also red with the knees black.

Georgia, Illinois. Wisconsin, Nevada.

S. cariosus Oliv. Ent. V. 83, p. 91, pl. 28, fig. 415 ; *larvatis* Germ. Ins. Spec. nov. p. 301; *cicatricosus* Say Curc. p. 22; Am. Ent. edit. Lec. I., p. 289 ; *flexuosus* Gyll. Schönh. Gen. Curc. IV., p. 940.

Black, shining, usually more attenuate behind. Rostrum nearly as long as thorax, moderately compressed, sparsely and at base more coarsely punctate, above slightly grooved at base, groove broader and deeper behind. Thorax broader than long, apex moderately constricted, gradually wider, ♂, rapidly broader ♀, and sub-parallel to base, the latter feebly bisinuate ; surface with three vittæ, the median attaining the apical margin, rapidly dilating to a rhomboid form, and very rarely prolonged by a very fine line to base, but usually ending abruptly at middle ; latteral vittæ sinuous, slightly broader at basal end, and emitting a lateral branch from the middle towards the basal angle, a small smooth callus near the anterior portion of the sides ; spaces between, and to the sides of the vittæ coarsely punctured and clothed with a feeble luteous coating. Scutellum longitudinally broadly grooved. Elytra conjointly emarginate, broader behind the base and arcuately narrowing to apex ; surface finely striate, striæ with rather deeply impressed, coarse, distant punctures, each surrounded with a luteous area, intervals flat, slightly irregular, third strongly elevated, cariniform at basal half, and with the humeral callus smooth, shining. Pygidium coarsely punctured, with short setæ along the middle and a tuft of hairs on each side of apex. Body beneath black, shining, coarsely punctured, mesosternum at sides coarsely foveate. Length .32–.44 inch ; 8–11 mm.

This species is one of the most readily recognized species in our fauna. Occurs in the Middle States, rarely ; Gulf States, abundantly.

S. latinasus, n. sp.

Moderately elongate, black, shining. Rostrum slightly longer than half the thorax, moderately compressed, rather suddenly dilated at apex, sparsely punctured, base rather suddenly dilated, above channelled. Thorax longer than wide, constricted in front, rather rapidly dilated to apical third, thence sub-parallel to base, above with three elevated, polished, entire vittæ, the median broadest at apex, then slightly narrower and elongate fusiform to base, lateral vittæ parallel, with a lateral branch toward the basal angle. Scutellum very feebly grooved. Elytra similar in form to *cariosus*, surface finely striate, striæ moderately coarsely punctured, punctures of the striæ opposite, regularly placed, intervals flat, sutural interval shining, sparsely punctulate, third cariniform for half its length and with the humeral callus smooth, the other intervals clothed with luteous coating. Pygidium scarcely narrower to apex, subquadrate coarsely punctured, with short setæ and a short tuft of hairs on each side of apex. Body beneath coarsely and sparsely punctured. Length .40 inch; 10 mm.

This species appears to combine the thoracic sculpture of *costipennis* with the elytral sculpture of *cariosus*, but differs from any species known to me by the curious form of the tip of the rostrum. The rostrum is rather suddenly dilated at tip and apparently slightly obliquely truncate, so that when the rostrum is examined at its end, there is seen above the mandibles an oval space, so that the parts of the mouth are more inferior than usual. The third joint of the hind tarsi is fully as dilated as those of the middle and anterior, and is also spongy pubescent at the sides, so that in this respect it has the character of the preceding group, and would have been placed there except that it lacks the glabrous natural coating, and the lateral vittæ have the external branch.

One specimen, Georgia.

Group V.

The third joint of all the tarsi in this group is of a sub-conical form, scarcely at all flattened, and beneath sparsely fimbriate at the antero-lateral margin.

The species are exceedingly troublesome to define, and tabulate in a satisfactory manner.

A. Rostrum arcuate, usually slender. Tibiæ simple.

Thorax more or less distinctly vittate. 1.

Thorax punctured nearly equally over the entire surface, rarely with a smooth, median, not elevated line or space, but never with any traces of lateral vittæ. 2.

1. Median vitta *entire in front.* 3.

Median vitta *bifurcate in front*, enclosing a slight fovea immediately behind the apical constriction. 4.

3. Median vitta more or less dilated at middle.
Median vitta broadly dilated at middle.
Surface glabrous.
Hind tibiæ ♂ simple..... zeæ.
Hind tibiæ ♂ subangulate with dense brush of long hairs..... scoparius.
Surface densely clothed with an argillaceous coating.
Third elytral interval sub-cariniform at basal half..... callosus.
Elytral intervals flat..... sculptilis.
Median vitta reduced to a slender apical carina, slightly dilated at the middle of thorax. Surface with argillaceous coating..... melanocephalus.
Median vitta fusiform, entire, lateral vittæ short, represented by an oblique basal line on each side of base..... Sayi.
4. Lateral thoracic striæ reduced to short oblique lines at base..... placidus.
2. Elytra rather deeply striate, striæ scarcely punctured, intervals coarsely, uniseriately punctured. Thorax coarsely, sub-confluently punctured, and with fine, smooth, median line; femora sparsely punctate.... gentilis.
Elytra moderately finely striate, striæ more coarsely punctured than the intervals and usually foveato-punctate.
Femora very coarsely foveato-punctate, with argillaceous coating..... parvulus.
Femora sparsely punctate, glabrous.
Thorax very coarsely punctate, a median fusiform impunctured space. Thorax large..... retusus.
Thorax not coarsely punctate.
Thorax sub-opaque, evenly punctate, elytra feebly attenuate behind..... arizonensis.
Thorax shining, unevenly punctate, elytra strongly narrowed at tip..... gagatinus.
B. Rostrum not arcuate, rather short, very strongly compressed. Anterior tibiæ at least very strongly toothed, or angulate at middle.
Anterior tibiæ without sub-apical mucro, median tooth strong.
Rostrum beneath with a laminiform carina terminating abruptly near the base. Thorax beneath coarsely punctate, opaque..... cultellatus.
Rostrum beneath not carinate, lower edge obtuse.
Thorax beneath sparsely punctate, shining..... compressirostris.
Anterior tibiæ strongly angulate at middle, sub-apical mucro moderately long..... Germari.

The last three species need no special comment, their characters being abundantly sufficient to distinguish them from any in the genus. The species in Section A are arranged as nearly as may be in such a sequence that the gradual obliteration of the thoracic vittæ may be shown. *S. zeæ* imitates the markings of *cicatricosus* of the preceding group, but the vittæ are much less elevated; *scoparius* is also similar, but the markings still more reduced. The next three species are always densely clothed with the argillaceous indument which almost entirely obliterates all sculpture. *S. callosus* has the thoracic punctures very large, being really erosions which are more or less confluent; *sculptilis* is punctured and not eroded, and has the elytral intervals flat. *S. melanocephalus* may readily be known by the median vitta being reduced to a narrow carina slightly dilated at tip, and which is situated at the anterior half of the median line, and on each side of which is a small callus. *S. Sayi* has the median vitta feeble but entire, and differs but slightly from the next species. The specific name *placidus* is chosen for an abundant and very variable form which has received many names, as it is the name by which it has come to be known to most of our entomologists. It may at all times be known by the median vitta of the thorax being bifurcate in front and between the two branches, immediately behind the apical constriction is a shallow fossa more or less marked, in which the punctures are denser and deeper. Among the species without the usual thoracic vittæ, *gentilis* is known by the deep elytral striæ which are as wide at bottom as at top, punctures not very evident, thorax coarsely and densely punctured, median fine line smooth; *parvulus* recalls *placidus*, and has the femora very coarsely foveato-punctate; *retusus* is a robust form with indistinctly defined, fusiform, impunctured thoracic space; *arizonensis* has the thorax comparatively finely punctured and all the elytral sculpture neatly defined; *gagatinus* is more attenuate posteriorly than any of the preceding, and the thorax shining with the punctures unevenly distributed.

S. zeæ Walsh, Practical Entomologist, II., p. 117; Riley, Third Annual Report, 1871, p. 59, fig 22.

Black, shining. Rostrum three-fourths the length of thorax, slender, slightly compressed, finely, at base more coarsely punctured, not canaliculate, and with a moderate puncture between the eyes. Thorax longer than wide, anteriorly constricted, sides gradually arcuate in front, at middle sub-parallel, base slightly narrower; surface with three elevated vittæ, as follows: median entire, very slender at each end, broadly dilated in front of middle, lateral vitta sinuous, interrupted opposite the broad portion of the median vitta, and with an oblique broad branch from the posterior portion extending toward the basal angle; spaces between the vittæ very coarsely, sub-confluently punctured. Scutellum slightly concave. Elytra oval, emarginate at base, surface finely striate, and with large foveæ rather irregularly placed along the striæ, becoming reduced to punctures toward the apex; intervals flat, very nearly equal, uni-seriately punctured, a slight callosity at humerus and tip of

seventh interval. Pygidium coarsely but sparsely punctured, with an oblique line of short yellowish hairs on each side. Body beneath very coarsely and densely punctured. Length .30-.36 inch ; 7.5–9 mm.

The tibiæ of both sexes are simple.

Occurs in Middle States, Georgia and Kansas.

S. scoparius, n. sp.

Agrees with the preceding in form, and differs as follows :

Thoracic vittæ, sub-obsolete, sparsely punctulate, intervals coarsely punctured. Elytra finely striate and with coarse foveate punctures becoming finer toward apex, intervals slightly alternating the wider biseriately, the narrower uni-seriately punctulate. Pygidium coarsely punctured, and with a slight tuft of hairs at apex on each side. Body beneath coarsely punctured. Length .36 inch ; 9 mm.

Male. Hind tibiæ stout, strongly angulate at middle of inner margin, and with a long dense brush of hairs at angulation and less densely pubescent from thence to apex.

Female. Tibiæ normal.

Two specimens, Wisconsin and Kansas.

Resembles also superficially some of the smaller varieties of *S. pertinax*, but the tarsal and sexual characters at once serve to distinguish it.

S. callosus Oliv. Ent. V., 83, p. 92, pl. 28, fig. 416 ; Gyll., Schönh., Curc. IV., p. 942.

Black, body above and beneath at sides, densely clothed with brownish argillaceous coating. Rostrum two-thirds the length of thorax, moderately compressed, above punctured, at base sub-canaliculate and more coarsely punctured. Thorax similar in form to that of *zeæ*, base much more distinctly lobed at middle, vittæ very indistinctly limited, their position indicated by very coarse variolate punctures, the median vitta incomplete posteriorly. Scutellum broadly transversely concave. Elytra oval gradually narrowed to apex, base feebly emarginate ; surface irregular, finely striate, striæ coarsely foveato-punctate, third interval at base obtusely elevated, callus at tip of seventh interval moderately elevated. Pygidium coarsely punctured, apex on each side with slight tuft of hairs. Body beneath coarsely but very sparsely foveato-punctate. Length .48 inch ; 12 mm.

This species resembles a *cicatricosus* which has become coated with mud, but the well-marked thoracic vittæ and the absence of variolate punctures in the latter at once distinguish it.

Occurs in the Gulf and Western States.

S. sculptilis Uhler. Proc. Acad., 1855, p. 416.

Body black, above entirely covered with dense argillaceous coating ochreous or pale brownish in color. Rostrum naked at tip, coated at base, two-thirds the length of thorax, sparsely and at base more densely and coarsely punctured. Thorax similar in form to *zeæ*, densely coated and with the vittæ moderately well marked ; median broadly dilated at

middle, separated from the lateral by a sinuous row of very coarse punctures, lateral vittæ very broad at base and with an oblique branch. Scutellum shining broadly concave. Elytra oval, moderately narrowed to tip, surface finely striate, striæ with very coarse punctures distantly placed, forming irregular transverse series, intervals sub-equal, surface irregular and evidently punctate, sub-apical callus feeble. Pygidium coarsely and sparsely punctured and slightly pubescent at tip. Body beneath glabrous at middle, coated at the sides, coarsely but very sparsely punctate. Legs coated. Length .28–.36 inch; 7-9 mm.

Closely allied to the preceding species, and has also the base of thorax moderately lobed at middle, it differs especially in its thoracic and elytral sculpture and smaller size.

Middle, Western and Southern States.

S. melanocephalus Fab. Syst. El. II., p. 435; Oliv, Ent. V., 83, p. 93, pl. 28, fig. 419; *nubilus*, Gyll., Schönh., Gen. Curc., IV., p. 938.

Body black, densely clothed above with pale ochreous or cinereous argillaceous coating. Rostrum two-thirds the length of thorax, compressed, tip slightly dilated, base rather suddenly wider over the insertion of the antennæ, sparsely punctured, at base much more coarsely and deeply. Thorax longer than wide, apex strongly constricted, in front suddenly broader, thence sub-parallel, base moderately lobed at middle, surface sparsely and coarsely punctured, vittæ short, median represented by a short apical carina slightly dilated posteriorly, lateral by an indistinct line; on each side near the front angles a small round callosity. Scutellum glabrous, slightly concave. Elytra moderately robust, oval, gradually narrowed behind, surface finely striate, striæ with coarse punctures moderately distantly placed, intervals flat slightly alternating, the seventh at tip slightly elevated in callus. Pygidium coarsely and sparsely punctured, a slight tuft of hairs on each side of tip. Body beneath very coarsely but sparsely punctured. Length .30–.38 inch; 7.5–9.5 mm.

When the surface coating is removed the intervals are seen to be uniseriately punctate.

Occurs from Georgia to Kansas.

S. Sayi Gyll. Schönh., Gen. Curc. IV., p. 943; *subcarinatus*, Mann. Bull. Mosc., 1843, II., p. 294; Schönh., Gen. Curc. VIII., 2, 255.

Piceous, frequently rufous, shining. Rostrum slender, three-fourths the length of thorax, suddenly dilated over the antennal scrobes, sparsely, at base coarsely and densely punctured, finely canaliculate and between the eyes transversely impressed. Thorax longer than wide, constricted in front, sides anteriorly rapidly broader, thence sub-parallel to base; above truncate, median vitta slightly abbreviated in front, at middle moderately dilated, thence finely prolonged to base, lateral vittæ sinuous, approximating in front, slender and without lateral process; surface coarsely punctured, on each side of median vitta variolate. Scutellum feebly longitudinally concave. Elytra elongate oval, slightly narrowed

to apex, surface striate, striæ coarsely punctured, punctures gradually finer to tip, intervals nearly equal, feebly convex, sparsely punctulate. Pygdium coarsely and sparsely punctured. Body beneath moderately and sparsely punctate. Length .26–.28 inch ; 6.5–7 mm.

Closely allied to the following species but differs especially in the absence of anterior fovea of thorax, the greater dilatation of the rostrum at base, and the absence of any evident alternation of the intervals.

Specimens are before me from Pennsylvania, Georgia, and Oregon.

S. placidus Say. Curc. N. A., p. 23 ; Am. Ent. edit. Lec. I., p. 290 ; *venatus*, Say, l. c., p. 22 ; l. c., p. 289 ; *rectus*, *immunis*, Say, l. c., p. 22–23 ; l. c., p. 290 ; *confusus*, Gyll., Schönh., Gen. Curc. IV., p. 944 ; *fallax*, Boh., l. c. VIII., 2, p. 256 ; *reticulaticollis*, Boh., l. c., p. 257.

As all of Say's descriptions were published at the same time, I have chosen that under which the species has been most widely distributed. Strictly speaking *venatus* is the first, and on the other hand *immunis* is described in a more recognizable manner than any of the others. The *reticulaticollis*, Boh., is scarcely worthy of being called a variety, and was probably described as distinct because it was Californian.

Black, feebly shining. Rostrum slender, three-fourths as long as the thorax, sparsely punctured and feebly canaliculate at base. Thorax longer than wide, anteriorly moderately constricted, sides moderately arcuate at apical third and sub-parallel to base ; above feebly trivittate, median vitta broadly dilated in front (inclosing an impression which is more coarsely and densely punctured), prolonged to a fine line at basal half ; lateral vittæ sinuate, joining the median in front, rarely with traces of oblique branch ; surface coarsely punctate, variolate on each side of median vitta at base. Scutellum smooth, very feebly concave. Elytra oval, moderately attenuate behind, surface finely striate, striæ coarsely punctured, punctures gradually finer to apex, intervals flat, slightly alternating in width and convexity, the narrower uni-seriately punctulate ; the broader bi-seriately. Pygidium coarsely punctured, at apex sparsely pilose. Body beneath coarsely and moderately closely punctate. Length .24–.40 inch ; 6–10 mm.

This species is very variable. The form above described, is that in which the sculpture is most developed, but many varieties occur, in which the lateral vittæ are reduced to oblique lines at base. The special character present in all the varieties, and which distinguishes the species from all others in our fauna, is the slight fossa at the anterior median portion of the thorax immediately behind the apical constriction.

Specimens occur in every part of our fauna, Pacific and Atlantic.

S. gentilis Lec. Pacif. R. R. Rep., 1857, p. 58.

Piceous or pale castaneous shining. Rostrum slender, three-fourths as long as thorax, sparsely, at base more coarsely punctured and finely canaliculate, and with an impressed point between the eyes. Thorax longer than wide, moderately constricted in front, sides anteriorly mod-

erately arcuate, sub-parallel or feebly arcuate to base; surface coarsely punctured, somewhat more densely in front, and with a fine, smooth median line. Scutellum not canaliculate, elytra oblong, slightly attenuate posteriorly, deeply striate, striæ not distinctly punctured, intervals flat, equal, very finely alutaceous, and with a single row of very coarse sub-quadrate punctures closely placed. Pygidium coarsely and equally punctured, sparsely pubescent at tip. Body beneath black, coarsely and sparsely punctured, legs piceous or rufous. Length .30–.34 inch; 75–8.5 mm.

The color is sometimes piceous, frequently castaneous, and in some specimens the thorax is piceous, and has on each side of the median smooth line a linear rufous space, and a similar space adjacent to the lateral margin.

Occurs in California.

S. parvulus Gyll. Schönh. Gen. Curc. IV., p. 961.

Black, with cinereous coating of argillaceous material. Rostrum three-fourths as long as thorax, sparsely punctate, base dilated over the scrobes, coarsely punctured, and moderately deeply canaliculate. Thorax moderately constricted at apex, sides in front strongly, thence moderately arcuate to base, surface densely and coarsely punctured, rarely with trace of median line, and at base a slight trace of oblique impression on each side of middle. Scutellum not channelled. Elytra oval, moderately narrowed to tip, surface finely striate, striæ with coarse punctures moderately distantly placed, gradually finer to tip, intervals slightly alternating in width and convexity, uni-seriately and rather coarsely punctate. Pygidium coarsely punctate, slightly fimbriate at apex. Body beneath coarsely, but not densely punctured. Legs coarsely punctate. Length .24 inch; 6 mm.

The smallest species in our fauna, easily known by the above characters.

Occurs in Pennsylvania, Georgia and Kansas.

S. pumilus Gyll. Schönh. Gen. Curc. IV., p. 960.

"*Oblongo-ellipticus, parum convexus, niger, opacus, sparsim cinereo-pulverulentus; thorace dense varioloso-punctato, in medio subcarinato; elytris obsolete, remote punctato-striatis; interstitiis planis, vix punctulatis, guttulis cinereis irroratis.*"

Similar to *S. parvulus*, but twice as large.

This species is unknown to me. It is placed next to *parvulus* by Gyllenhal.

S. retusus Gyll, Schönh. Gen. Curc. IV., p. 949.

Body robust, black, sub-opaque. Rostrum half the length of thorax, slightly arcuate, moderately compressed, and gradually broader to tip, sparsely punctulate between the eyes, flattened and deeply canaliculate. Thorax robust, slightly longer than wide, feebly constricted at apex, sides gradually arcuate, base slightly narrower, surface coarsely variolato-

punctate with median fusiform smooth space. Scutellum not canaliculate. Elytra oval gradually attenuate to tip, scarcely larger than the thorax and head, surface striate, striæ with very coarse punctures at basal half, rapidly finer to tip, intervals equal, slightly irregular, and indistinctly uni-seriately punctate. Pygidium very feebly exposed, coarsely punctate. Body beneath coarsely but sparsely punctate. Legs finely punctured. Length .32–.40 inch ; 8–10 mm.

Occurs in the Southern States.

S. arizonensis, n. sp.

Black, feebly shining. Rostrum longer than half the thorax, moderately stout, slightly wider at tip, moderately compressed, sparsely punctulate, at base slightly dilated, more distinctly punctate, and finely grooved. Thorax longer than wide, apex moderately constricted, sides in front strongly arcuate, thence feebly arcuate to base, surface sparsely punctate, punctures coarser toward the middle, and denser at base, a faint trace of smooth median line. Scutellum slightly grooved. Elytra oval, arcuately narrowing to tip, surface finely striate, striæ with very coarse punctures in their entire length, intervals flat, equal, finely uniseriately punctulate. Pygidium moderately strongly elevated along the median line, coarsely sub-muricately punctured, at tip smoother. Body beneath sparsely and finely punctulate, femora very finely punctured. Length .36 inch ; 9 mm.

A species with very neat appearance, easily known by the above characters.

Occurs in Arizona.

S. gagatinus Gyll. Schönh. Gen. Curc. IV., p. 952 ; ? *necydaloides*, Fab. Syst. El. II., p. 435 ; Oliv. Ent. V., 83, p. 94, pl. 28, fig. 420.

I am not quite certain that these two species are synonymous, as the latter is so briefly described as to be very unsatisfactory. The latter is the older name should they prove identical.

Black, shining. Rostrum three-fourths the length of thorax, feebly compressed, scarcely dilated at base, minutely punctulate, at base finely grooved, groove more deeply impressed between the eyes. Thorax longer than wide, anteriorly constricted, sides moderately arcuate from that to base, surface shining, unequally punctured, punctures sparse and fine over the greater part of the surface, coarser and denser along the base and from the latter coarse punctures extend forwards on each side of the median line, and also slightly within the hind angles, punctures coarse at the apical constriction. Scutellum feebly concave. Elytra oval, scarcely larger than the head and thorax, rapidly narrowed to apex, surface striate, striæ moderately deep, and with coarse punctures gradually evanescent toward the apex, intervals flat, equal, finely punctulate. Pygidium narrow, coarsely punctured, at tip slightly pubescent. Body beneath coarsely and closely punctured, femora minutely punctulate. Length .30 inch ; 7.5 mm.

Easily known by the shining thorax and rapidly narrowed elytra.

One specimen from Georgia.

S. cultellatus, n. sp.

Body robust, black, opaque. Rostrum longer than half the thorax, straight, strongly compressed, above acutely carinate, especially near the tip, beneath with acute laminiform carina, terminating opposite the scrobes by an abrupt sinuation, surface above coarsely at base densely punctured and slightly canaliculate. Front coarsely punctured. Thorax robust, longer than wide, anteriorly scarcely constricted, sides moderately arcuate in front and slightly narrowing to base, surface varolato-punctate, median line slightly elevated. Scutellum not grooved. Elytra scarcely longer than head and thorax, oval, arcuately, and feebly narrowed to tip, surface deeply and broadly striate, striæ catenulate, intervals narrower than the striæ, alternately broader, the narrower cariniform, the broader bi-seriately punctulate. Pygidium coarsely, muricately punctate. Body beneath coarsely but sparsely punctured. Anterior tibiæ with strong obtuse spur above the middle, sub-apical mucro wanting, apical slender and longer than usual; middle and hind tibiæ with the spur sub-median. Length .30–.34 inch; 7.5–8.5 mm.

The femora are very robust, the under side of thorax coarsely punctured. The form of rostrum will easily distinguish the species.

Occurs in Kansas and Texas.

S. compressirostris Say. Journ. Acad., 1823, III., p. 319; Am. Ent. edit. Lec. I., p. 20; *cultrirostris*, Gyll. Schöh. Gen. Curc. IV., p. 951.

Black, feebly shining. Rostrum longer than half the thorax, straight, strongly compressed, above acutely carinate, especially at tip, moderately coarsely punctured, base dilated and with a strong puncture between the eyes. Thorax longer than wide, apex moderately constricted, sides moderately strongly arcuate to base, surface irregularly punctured, at middle sparsely, coarsely variolato-punctate at the sides and on a line each side of middle converging at base. Scutellum moderately convex. Elytra oval, gradually narrowed to apex, surface striate, striæ not deep, coarsely and rather distantly punctured in their entire length; intervals equal, at middle more elevated and uni-seriately punctulate. Pygidium cribrate. Body beneath with prothorax and middle nearly smooth, sides and last ventral segment coarsely punctured. Anterior tibiæ with strong median oblique tooth, middle and hind tibiæ less strongly toothed, tooth sub-median. Length .28–.34 inch; 7–8.5 mm.

Say and Germar used the name *compressirostris* for two distinct species at nearly the same time, and it is difficult to decide, if date of publication is considered, which should be suppressed. I follow the catalogue of Gemminger and Harold, although they incorrectly place the two names as equivalent. Gyllenhal's *cultrirostris* is, however, a synonym under any circumstances.

Occurs from Kansas to Texas.

S. Germari Horn ; *compressirostris* ‡ Germ. Ins. Spec. Nov. p. 300, 1824 ; Boh. Schön. Gen. Curc. VIII., 2, p. 258.

Black, sub-opaque, form robust. Rostrum three-fourths the length of thorax, strongly compressed, very slightly arcuate, upper edge not carinate, base moderately dilated, very coarsely punctured, and concave between the eyes. Thorax longer than wide, anteriorly moderately constricted, sides in front strongly, thence gradually arcuate to base, surface coarsely variolato-punctate, with large eroded spaces. Scutellum with faint median line. Elytra robust, oval, moderately attenuate to tip, surface striate, striæ not punctured, intervals alternating in width, bi- and uni-seriately coarsely punctate and with large shallow foveæ very irregularly disposed over the entire surface. Pygidium cribrate. Body beneath coarsely variolato-punctate. Anterior tibiæ strongly angulate at middle, sub-apical mucro distinct, middle tibiæ subangulate below the middle, hind tibiæ slightly sinuous. Length .38–.40 inch ; 9.5–10 mm.

This species forms a link between the sections A and B, by the anterior tibiæ being only angulate and the sub-apical mucro present on all the tibiæ.

Occurs in Kansas and Texas.

Calandra Clairv.

Sitophilus Schönh.

Metasternal side pieces narrow, mesosternal epimera ascending, acute above. Anterior coxæ widely distant.

Two species occur in our fauna.

Surface opaque, thorax very densely punctured..... oryzæ.
Surface feebly shining, thorax sparsely punctured.... remotepunctatus.

C. oryzæ Linn. Amoen. Ac. VI., 1763, p. 395 ; Oliv. Ent. V. 83, p. 97, pl. 7, fig. 81 *a*, *b* ; Schönh. Gen. Curc. IV., p. 981.

Color variable from ferruginous to piceous, elytra frequently with four rufous spots, surface opaque. Rostrum slender cylindrical, three-fourths as long as the thorax, at base slightly dilated, surface above with moderately coarse punctures arranged in four series and with a slight fossa between the eyes. Thorax longer than wide, anteriorly constricted, sides feebly arcuate and gradually divergent to base, surface densely and coarsely punctured, punctures with very short setæ. Elytra oblong, slightly narrowed at tip, surface deeply striate, striæ very coarsely and closely punctured, intervals slightly convex, narrow, the sutural with a row of coarse punctures, punctures with very short setæ. Pygidium rugosely cribrate and with short setæ. Body beneath very densely and coarsely punctured. Legs coarsely punctured and with short setæ. Length .12–.14 inch ; 3–3.5 mm.

This species occurs in every portion of our fauna, and, in fact, of the world, and is only too well known.

C. remotepunctatus Gyll. Schönh. Gen. Curc. IV., p. 979.

Piceous, moderately shining, similar in form to the preceding, but more convex, thorax sparsely punctate, punctures coarse and on the disc more or less fusiform. Elytra deeply striate, striæ punctured at bottom, not serrate, intervals subequal convex, the sutural with a row of elongate punctures. Pygidum coarsely cribrate. Body beneath coarsely but less densely punctured than *oryzæ*. Length .12–.14 inch; 3–3.5 mm.

In well preserved specimens the surface has fine, short setæ as in the preceding, but they are much more apt to be lost.

Occurs from Canada to Arizona.

Other species of Calandra have been from time to time introduced into our country by ships from tropical ports, although none have found permanent lodgment, as far as I am aware.

COSSONIDES.

This tribe as restricted by Lacordaire (Genera vii, 319), appears to be entitled to higher rank than is assigned it by that author, but a discussion of the merits of this view would require a revision of the entire family and is not pertinent to the objects of the present essay.

The groups as established by Lacordaire appear hardly to be of equal value, and some are composed of rather heterogeneous material. The small number of genera represented in our fauna renders it impossible for me to suggest any change in their arrangement that would be at all applicable to the larger number of exotic genera.

Funicle of antennæ 4-jointed, tarsi 5-jointed.....DRYOPHTHORIDES.
" " " 5-jointed.....PENTARTHRIDES.
" " " 7-rarely 6-jointed.
Metasternum very short, eyes placed on the rostrum...LYMANTIDES.
Metasternum elongate, eyes placed normally.....COSSONIDES.

DRYOPHTHORIDES.

This group contains in our fauna, but one genus, remarkable for being the only exception in the entire family in which the tarsi are five-jointed.

DRYOPHTHORUS, Schönh.

The antennal insertion is nearer the base than the middle; Lacordaire calls it submedian. The mesosternum in our species is not narrow, but much more widely separates the coxæ than the anterior coxæ are separated by the prosternum. Lacordaire says, "*mesosternum étroit*" and "*pattes antérieures assez largement séparées,*" and these characters may really exist in *D. lymexylon*, from which the generic description was probably drawn.

D. corticalis Say, Descr. Curc. N. A. p. 24; Am. Ent. edit. Lec. 1, p. 292; Boh. Schönh. Gen. Curc. IV, p. 1089.

Brownish or piceous, opaque. Rostrum longer than half the thorax, sub-cylindrical, slightly dilated at tip, above slightly sulcate at base, sur-

face coarsely punctured. Head coarsely but sparsely punctured. Eyes oval, transverse coarsely granulated, situated at base of rostrum. Thorax longer than wide, strongly constricted in front, sides behind the constriction moderately arcuate, thence sub-parallel to base which is slightly narrower; surface coarsely variolato-punctate. Scutellum invisible. Elytra elongate oval, at base broader than thorax; sides arcuate, feebly converging to apex; surface deeply and broadly striate, striæ coarsely punctured at bottom, intervals narrow, cariniform but obtuse at summit. Body beneath coarsely but sparsely punctured. Suture between the first two abdominal segments deeply impressed. Anterior coxæ moderately distant, middle coxæ nearly three times as widely separated, hind coxæ very distant, closely approximating the margin of the elytra. Inter-coxal process broad, short, truncate in front. Tarsi five jointed. Length .10 inch; 2.5 mm.

The funicle of the antennæ is composed of four joints only, the club rather suddenly formed and oval. This species from the tarsal and antennal characters, is one of the most easily known Rhynchophor in our fauna.

Occurs over our entire fauna east of the Mississippi, under bark.

Dryophthorus bituberculatus Fab. is said by Boheman to occur in California.

Pentarthrides.

This group is characterized by the funicle of the antennæ having five joints. Two genera occur in our fauna which possess otherwise rather diverse characters, one being of the general aspect of *Dryophthorus*, the other of the commoner *Rhyncolus* type.

Eyes small, rounded, very coarsely granulated, situated on the rostrum. Elytra oval..... Dryotribus.

Eyes moderate, oval, not very coarsely granulated, situated on the head.

Elytra oval, scape of antennæ long, scrobes encroaching on the eyes beneath.....Amaurorhinus.

Elytra cylindrical, scape short, scrobes beneath the eyes posteriorly.....Wollastonia.

Dryotribus, n. g.

Habitus of *Dryophthorus corticalis*. Rostrum moderately elongate, arcuate, slightly flattened, at base constricted. Head suddenly broader than the rostrum, globular. Eyes small, very coarsely granulated, composed of about twenty facets, round, situated at the side of rostrum one-fifth from base. Antennæ inserted midway between the eyes and tip of rostrum, scrobes moderately deep in front, lateral, gradually becoming inferior, not confluent posteriorly and not encroaching upon the eyes. Scape of antennæ elongate, feebly clavate at tip, as long as the remaining joints together; funicle five-jointed, first joint obconical, stouter and longer thon the following, second obconical slightly longer than the third,

joints 3–4–5 subequal gradually broader, club oval slightly flattened, pubescent at tip. Thorax longer than wide. Scutellum invisible. Elytra elongate oval, narrowed at base and apex. Anterior coxæ moderately distant, middle nearly twice as widely separated, hind coxæ very distant, intercoxal process short truncate in front. First ventral suture entirely obliterated at middle. Tarsi moderately stout, slightly pubescent beneath, the third joint feebly emarginate. Metasternum moderately long.

The above characters will serve to distinguish this genus from any other hitherto described. It is represented by one species.

D. mimeticus, n. sp.

Brownish or piceous, opaque. Rostrum three-fourths the length of thorax, coarsely variolato-punctate. Thorax one-fourth longer than wide, moderately convex, at anterior fourth constricted, sides moderately arcuate, base as narrow as the constriction, surface densely variolato-punctate. Elytra elongate oval, broader than the thorax, humeri broadly rounded, sides moderately arcuate, at apical third gradually narrower to tip; surface broadly striate, striæ coarsely punctured, intervals narrow, at summit with a series of moderately coarse, submuricate punctures. Body beneath very coarsely but sparsely punctured, legs coarsely punctured, and with a few short yellow hairs. Length .10 inch; 2.5 mm.

This insect closely resembles *Dryophthorus corticalis*, and might readily be mistaken for it on a hasty examination.

Two specimens collected at Key West, Florida, by Mr. Edward Norton.

WOLLASTONIA, n. g.

Head stout, obconical. Eyes round, feebly convex, moderately coarsely granulated. Rostrum slightly longer than the head, robust, sub-cylindrical, not arcuate. Scrobes commencing at middle, deep, rapidly becoming inferior and distant from the eyes posteriorly. Antennæ robust, scape short robust not longer than half the length of the remaining joints; funicle five-jointed, first joint stout, longer than the others, 2–5 sub-equal broader than long; club round, sub-truncate at tip, glabrous, pubescent at tip, composed almost entirely of the first joint. Thorax longer than wide, cylindrical, but slightly narrowed in front. Scutellum small, rounded at tip. Elytra cylindrical very slightly broader than the thorax. Legs short, robust, tarsi nearly as long as the tibiæ, first and second joints slender, subequal third slightly broader but not bilobed, fourth as long as the preceding together, slender. Anterior and middle coxæ feebly separated, hind coxæ distant, intercoxal process short, sub-truncate in front. Metasternum moderately long.

Closely allied to *Pentarthrum*, but differs by the position of the antennal scrobes, and the more narrowly separated anterior and middle coxæ. In the present genus the scrobes pass entirely beneath the eyes, and are distant from their lower edge. In *Pentarthrum* the scrobes attain the eyes.

Dedicated to Mr. T. V. Wollaston, who has increased our knowledge of the Cossonides by his valuable essay on the genera and species of the Canary and adjacent islands.

W. quercicola. (? *Rhyncolus quercicolus* Boh. Schönh. Gen. Curc. VIII., 2, p. 281.)

Black, feebly shining. Rostrum finely punctured at tip, more coarsely, but much less densely at base. Thorax longer than wide, nearly cylindrical, very slightly narrowed in front, surface coarsely but not densely punctured. Elytra cylindrical scarcely wider than the thorax, humeri moderately prominent, surface finely striate at base, striæ much deeper at apex, with very coarse and deep punctures moderately closely placed; intervals feebly convex, uni-seriately punctulate, tip of elytra with margin slightly prolonged and feebly reflexed. Body beneath black, feebly shining, coarsely variolato-punctate. Legs piceous sparsely punctured. Length .12 inch; 3 mm.

South Carolina, Louisiana, Georgia. I quote the synonym with some doubt, although the specific description agrees very well.

AMAURORHINUS Fairm.

A ? nitens, n. sp.

Black, shining. Rostrum half as long as thorax, finely punctured, and with an impressed puncture between the eyes. Thorax as wide as long, oval, base slightly wider than apex, sides moderately arcuate, surface moderately convex, coarsely and regularly, but not densely punctured. Scutellum small, smooth. Elytra oblong, humeri moderately prominent, sides feebly arcuate, slightly broader behind the middle, margin slightly prolonged at tip, and somewhat reflexed, surface finely striate, striæ moderately punctured, intervals (slightly convex at base) flat, finely uniseriately punctured. Body beneath shining, coarsely and sparsely punctured, abdomen more finely punctured. Length .10 inch; 2.5 mm.

I refer this species with doubt to the above genus, as the characters have never been exposed at sufficient length to determine the point definitely. It corresponds with the description as far as it goes. The following characters are added for the present species, that its position may be determined.

Rostrum slightly longer than the head, slightly arcuate. Scrobes deep, beginning at the middle of the rostrum, encroaching on the eyes behind. Eyes oval, slightly transverse, moderately convex, not coarsely granulated. Anterior coxæ very closely approximated, middle moderately distant, hind coxæ distant, intercoxal process short, slightly arcuate in front. Third tarsal joint moderately emarginate.

Occurs abundantly in Florida.

LYMANTIDES.

The distinction between this group and the next is not very well marked in the genus, which we have in our fauna, the only difference being in the short mesosternum of the former, and the longer mesoster-

num of the Cossonides. *Lymantes* has the eyes placed on the rostrum, and as far as our fauna is concerned, is the point of greatest difference, but *Catolethrus* of the next group has a similar structure.

LYMANTES Schönh.

Head globular, rostrum separated from it by a deep constriction, moderate, robust, subquadrangular, rounded at the angles, arcuate; scrobes commencing a short distance from the tip, oblique, visible only in front. Antennæ anterior, moderately robust, scape gradually clavate, nearly attaining the eyes; funicle seven-jointed; 1–2 elongate, obconic, the former longer, 3–7 transverse, closely placed, increasing gradually in width; mass moderately large, subglobular, compact. Eyes situated on the rostrum, lateral, small, depressed, narrow, obliquely transverse. Thorax oblong quadrate, depressed, suddenly and for a short distance narrowed in front, truncate at apex and base. Scutellum invisible. Elytra moderately convex, gradually declivous behind, narrower at posterior third, not larger at base than thorax and feebly emarginate. Legs moderate, anterior coxæ feebly separated, thighs gradually in mass, the anterior more strongly than the others; tibiæ narrow, a little compressed, slightly arcuate at the extremity, which is mucronate. Tarsi short filiform, fourth joint long, claws slender parallel. Mesosternum narrow, linear. Form oblong, elongate, unequal.

The above description of the genus is copied from Lacordaire as the species is unknown to me in nature.

L. scrobicollis Gyll. Schönh. Gen. Curc. IV., p. 1086.

"Elongatus, angustus, subdepressus, nigropiceus, nitidus, parce cinereo-setulosus, antennis pedibusque dilutius ferrugineis; rostro porrecto, seriatim rude punctato; thorace oblongo, disperse varioloso-punctato; elytris remote punctato-striatis, interstitiis angustis, punctulis valde remotis adspersis, setulis parvis cinereis, præsertim versus apicem adspersa. Corpus subtus profunde disperse punctatum, nigro piceum."

Of the size and facies of *Dryophthorus*.

For a time I supposed the insect, which has been described on a previous page as *Dryotribus mimeticus*, to be *Lymantes*, of which it has many of the characters; but their identity cannot be for a moment suspected without admitting inaccuracies on the part of Schönherr and Lacordaire which are almost inconceivable, although the latter author states in the table (Genera, VII., p. 328) of genera that *Lymantes* is eyeless, and on a subsequent page (p. 332) the eyes and their position are carefully described.

COSSONIDES.

Funicle of the antennæ seven jointed. Eyes normally placed. Metasternum at least moderately long.

The above is all that can be said in general of the genera which compose this group. Many of the genera are extremely closely allied, and as but few are known to me in nature, I have been compelled to rely entirely on the books.

Our genera are as follows:

Rostrum always longer than the head.
  Elytra narrowed at base and apex, form oval. Anterior coxæ narrowly separated.
    Eyes distinct, scape resting at a distance from them.. Elassoptes.
  Elytra parallel, cylindrical, or slightly depressed.
    Scape of antennæ impinging on the eyes when at rest.
      Anterior coxæ distant..... Cossonus.
      Anterior coxæ very narrowly separated..... Phlœophagus.
    Scape resting at a distance from the eyes.
      Funicle seven jointed..... Rhyncolus.
      " six " ..... Hexarthrum.
Rostrum shorter than the head and very stout.
  Lateral lobes of submentum prominent anteriorly.... Stenoscelis.

Cossonus and Rhyncolus are especially difficult to separate, as the fact of the scape impinging on the eyes when at rest appears to depend in great part to the length of the scape itself, and also on the size of the eyes. Rhyncolus has, however, the rostrum more robust, and in our species not much longer than the head and feebly narrower.

ELASSOPTES, n. g.

Rostrum stout, feebly arcuate. Antennæ median, scape rather slender feebly clavate to tip, funicle seven-jointed, first joint short, stouter than the following, joints 2–7 gradually and very feebly broader, mass oval rather abruptly formed, truncate at apex. Eyes small, oval, flat, coarsely granulated, and distant from the scape when the latter is at rest. Thorax slightly wider than long, sides strongly arcuate, apex and base truncate. Scutellum invisible between the elytra. Elytra convex, oblong oval. Legs moderate, anterior and middle coxæ extremely narrowly separated, hind coxæ moderately distant, intercoxal process rounded in front. Femora feebly clavate, slightly compressed, tibiæ moderately compressed with strong falcate process at outer angle, inner angle with short spine. Tarsi slender, nearly as long as the tibiæ, first joint nearly equal to the fourth and longer than 2 and 3 together, the latter subequal, the third being slightly shorter, not bilobed, fourth slightly longer than the first, and with small claws.

This genus is closely allied to *Lipommata*, Woll., and differs in the presence of eyes, the more slender antennæ and tarsi. Other differences probably exist which might be determined on comparison. The anterior coxæ are more prominent than is usual among our Cossonides.

E. marinus, n. sp.

Form moderately robust, color ferruginous or brownish, shining. Rostrum longer than the head, stout, feebly arcuate, slightly elliptical in transverse section, coarsely and densely punctured at tip, median line smoother, head sparsely punctate. Thorax slightly broader than long, anteriorly narrower, sides rather strongly arcuate, basal angles rounded. Elytra oblong oval, convex, posteriorly rapidly declivous, sides clasping

the body, surface with striæ of coarse punctures at base, punctures replaced gradually toward apex by rounded tubercles. Body beneath finely alutaceous and obsoletely sparsely punctate. Length .12 inch; 3 mm.

This species is totally unlike anything in our fauna, and bears considerable resemblance to the figure of *Mesoxenus Bewickianus*, Woll., Trans. Ent. Soc. Lond., n. s. Vol. V., pl. 19, fig. 6.

Occurs on the sea beach near San Francisco. Specimens have been sent me by Messrs. Edwards and Behrens.

Cossonus Clairv.

The species of Cossonus may be divided into three groups which may have generic value:

Rostrum dilated at tip. Body more or less depressed..... A.
Rostrum not dilated at tip.
  Body linear, strongly depressed. Scape of antennæ barely attaining the eyes. Rostrum porrected..... B.
  Body convex. Scape of antennæ impinging on the eyes when at rest..... C.

A.

This group may be considered to represent the typical *Cossonus*. The rostrum is always distinctly dilated at tip, the antennal scorbes deep and the ridge forming their lower boundary always visible from the front. The species all resemble each other very closely and are difficult to separate:

Thorax truncate at base. Antennæ post-median ..... Bohemanni.
Thorax bi-sinuate at base. Antennæ median.
  Thorax broader than long, sides arcuate, surface very unequally punctured..... platalea.
  Thorax longer than wide, sides very feebly arcuate or straight.
    Base of thorax with slight tuberosity opposite the scutellum.
      Basal portion of rostrum longer than the dilated portion..... subareatus.
      Basal portion equal to the dilated portion.
        Thorax narrower than the elytra, with coarse distant punctures, elytral punctures coarse.
          Thorax sub-depressed without concavity..... piniphilus.
          Thorax longitudinally convex, median line slightly concave behind..... concinnus.
        Thorax as wide as the elytra, punctures coarse but not distant, elytral punctures finer, serrate.
          Color black, striæ deeper and broader at base.... crenatus.
          Color piceous, striæ scarcely deeper and broader at base..... corticola.
    Thorax with median line at base sub-cariniform.
      Basal portion of rostrum scarcely equal to the apical. impressifrons.

C. Bohemanni *platalea*,‡ Boh. Sch. Gen. Curc. IV., p. 998.

"Nigro-piceus, nitidus, glaber, supra deplanatus, antennis, tibiis, tarsisque ferrugineis; rostro capite duplo longiori, tenuiori, apice minus sensim dilatato; thorace latiori subquadrato, antice evidenter coarctato, supra in ipsa basi obsolete bis impresso, dorso remote lateribus crebre punctato; elytris profunde punctato-striatis, interstitiis latioribus majis convexis."

This species is unknown to me in nature. The antennæ are said to be post-median (?) and the sides of the thorax nearly straight, the base of the thorax is also truncate. It is certainly not the species described by Say, as the elytra are distinctly wider than the thorax in the latter. I have copied Boheman's diagnosis with the change of name rendered necessary by the erroneous identification.

C. platalea Say. Descr. Curc. N. A., p. 24; Am. Ent. edit. Lec. 1, p. 292.

Black, shining. Rostrum longer than half the thorax, moderately arcuate, apex quadrangularly dilated, basal portion longer than the apical, cylindrical, slightly compressed, surface sparsely punctured, at base not sulcate. Thorax as wide as long, apex rather suddenly narrowed, base feebly bi-sinuate and on each side of middle slightly impressed, sides strongly and regularly arcuate, surface flattened, unequally punctured, punctures at the sides denser and finer, at middle coarser and more sparsely placed. Elytra broader than the thorax, flattened, striate, striæ coarsely and serrately punctured, intervals flat, very minutely uniseriately punctulate. Body beneath sparsely punctured. Length .24 inch; 6 mm.

This is the only species in our fauna in this group in which the sides of the thorax are regularly arcuate.

Occurs in the Middle States, under bark.

C. subareatus Boh. Schönh., Gen. Curc. VIII., 2, p. 266.

Differs from *platalea* as follows:

Rostrum at base with a distinctly impressed puncture. Thorax longer than wide, apex moderately constricted, sides in front arcuate, at middle parallel; basal angles rounded. Elytra scarcely wider than thorax, striate, striæ coarsely and serrately punctured, intervals convex punctulate as in *platalea*. Body beneath sparsely and rather finely punctured. Length .20 inch; 5 mm.

The sides of the thorax are more densely punctured than the rest of the surface, within this the punctures are fine and much sparser, and along the middle the punctures are coarser and rather deeply impressed, especially near the base. This and the preceding species have the club of the antennæ much more suddenly formed and the funicle more slender than in any of the species which follow.

Occurs from the Middle States to Kansas.

C. piniphilus Boh. Schönh. Gen. Curc. IV, p. 1002; Mann. Bull.

Mosc. 1843, II, p. 295; *scrobiculatus* Lec. Proc. Acad. 1859, p. 285; Col. Kansas, p. 18; ?*californicus* Motsch. Bull. Mosc. 1845, 1, p. 99.

Black, shining. Rostrum scarcely longer than half the thorax, apical portion quadrangularly dilated and longer than the basal portion, surface sparsely punctured, feebly canaliculate. Thorax oblong, narrower in front, sides feebly arcuate and gradually divergent to base, apex truncate, base feebly bi-sinuate and on each side feebly impressed, median line impunctured, surface feebly depressed, coarsely and deeply but sparsely punctured. Elytra slightly wider than the thorax, surface feebly depressed, deeply striate, striæ wider and deeper at base, coarsely punctured, intervals moderately convex, very minutely sparsely punctulate. Body beneath black, shining, sparsely punctured. Length .14–.18 inch; 3.5–4.5 mm.

This species resembles *crenatus*, but may be readily known from all the species which follow, by the punctures of the striæ being coarse and each one distinct, all the others having the punctures finer and very closely placed. I have before me a typical specimen sent by Mannerheim and also the type of *scrobiculatus*, and the only observable difference being in the better developed form of the latter, the former being smaller and piceo-rufous.

Occurs in California and Oregon.

C. concinnus Boh. Schön. Gen. Curc. IV, p. 1006.

Moderately convex, black, shining. Rostrum not as long as half the thorax, quadrangularly dilated at apical portion which is longer than the basal, surface sparsely punctured, base canaliculate, thorax moderately convex, longer than wide, median line slightly depressed, sides moderately strongly arcuate, base feebly bi-sinuate, surface coarsely and deeply punctured over the entire surface and in the basal impressions cribrate. Elytra not wider than the thorax, moderately convex, deeply striate, striæ coarsely and serrately punctured, intervals moderately convex, at apex flatter. Body beneath moderately punctured. Length .18–.22 inch; 4.5–5.5 mm.

Boheman says the antennæ are post-median and the third and fourth abdominal segment smooth, neither of which can I detect. This species may be known by its much more convex thorax than any other in the present group.

Occurs from Canada to Georgia and Missouri.

It is possible that the species so well described by Boheman (and to which the above is equivalent) as *concinnus* is really the true *corticola* Say, but as Say's types are not extant and the description may be construed to fit either the present or the next, I do not deem it advisible to complicate the synonymy by any change based on mere opinion.

C. corticola Say, Curc. N. A., p. 24; Boh. Schön. Gen. Curc. IV. p. 1005.

Piceous, elongate, sub-depressed. Rostrum not as long as half the

thorax, moderately punctured, at base an impressed puncture sometimes prolonged into a short groove, at apex feebly dilated, basal portion shorter than the apical. Thorax oblong, feebly constricted at apex, sides in front feebly arcuate, at middle nearly straight and slightly divergent, base slightly narrowed and bi-sinuate, surface depressed at sides moderately closely punctured, disc at centre frequently impunctured, toward the base coarsely punctured. Elytra elongate, parallel, sometimes narrower than the thorax, surface deeply striate, striæ seriately punctured, intervals narrow, at apex flat, finely uni-seriately punctulate, body beneath piceous, shining, coarsely and on the thorax densely punctured. Length .16–.20 inch ; 4–5 mm.

This species has the facies of being the most elongate of the section. The thorax is more sparsely and irregularly punctured, the coarser punctures at base being so arranged as to give the ante-scutellar tuberosity the appearance of being prolonged into a carina. The elytra are also less deeply and broadly striate than in the preceding species.

Occurs more abundantly in the Gulf States.

C. crenatus, n. sp.

Black, shining. Rostrum shorter than half the thorax, moderately coarsely and deeply punctured, at base feebly canaliculate, apex feebly quadrangularly dilated and longer than the basal portion. Thorax oblong, anteriorly feebly constricted, sides in front moderately arcuate, at middle feebly arcuate or nearly straight, at base narrower, base bi-sinuate, surface feebly depressed, coarsely deeply and moderately closely punctured. Elytra not wider than the thorax and twice as long, surface deeply striate, striæ deeper and broader at base, moderately coarsely and serrately punctured, intervals convex, narrow, with a single series of very minute punctures. Body beneath black, shining, coarsely and moderately densely punctured. Legs piceo-rufous. Length .16–.20 inch ; 4–5 mm.

This species resembles *piniphilus*, but the latter has the thorax very evidently narrower than the elytra and the punctures moderately distantly placed.

Occurs in Northern California and Oregon, under pine bark.

C. impressifrons Boh. Schön. Gen. Curc. IV, p. 1001.

Black or piceous, shining. Rostrum scarcely as long as half the thorax, sparsely punctured, apical portion very feebly quadrangularly dilated and distinctly longer than the basal portion, vertex with a deeply impressed, puncture slightly above the eyes. Thorax oblong, narrower in front, sides feebly arcuate from apex to base, the latter slightly narrower, bi-sinuate, surface coarsely punctured, at sides slightly more densely, median line at base distinctly cariniform. Elytra not wider than the thorax, moderately convex, deeply striate, striæ moderately coarsely and serrately punctured, intervals narrower at base, acute, at apex broader and flat, indistinctly uni-seriately punctulate. Body beneath sparsely punctured. Length .12–.14 inch ; 3–3.5 mm.

This species is the smallest of the present section and is readily known by the sub-carinate median line at base.

Pennsylvania (Boheman) and Florida.

B.

This group contains one very small species of elongate form, rufous color, and with the rostrum porrected. The scape of the antennæ barely attains the eyes, the scrobes deep, very gradually becoming inferior and more widely separated than usual in the genus. The anterior coxæ are widely separated.

The unique species is referred with doubt to *Phlœophagus* by Boheman, but the distant anterior coxæ forbids such a reference.

C. pallidus Boh. Schönh, Gen. Curc. VIII., 2, p. 279.

Linear, rufo-testaceous, depressed, shining. Rostrum cylindrical, feebly arcuate, slightly longer than half the thorax, sparsely punctured, and with an impressed point between the eyes. Thorax oblong, sides gradually divergent from apex, base slightly narrower and feebly arcuate, surface depressed, sparsely punctured, punctures finer in front. Elytra slightly wider than the base of thorax, depressed, striate, striæ deeper at apex, moderately punctured, intervals moderately convex, very minutely uni-seriately punctulate. Body beneath sparsely punctured. Length .06 inch ; 1.5 mm.

This is the smallest Cossonide in our fauna, and is probably the smallest Curculionide.

Occurs from the District of Columbia southward.

C.

The rostrum is cylindrical, slightly arcuate. Scape of antennæ impinging on the eyes, scrobes moderately deep, rather widely separated at their termination beneath.

The species of this group appear to approach closely to *Phlœophagus*, from which they differ in the widely separated anterior coxæ. From all the Cossonus which precede, they differ in their more convex form and more robust facies. I can find no character worthy of being made use of to separate the species generically.

Three species form this group, two of small size and a third is the largest in the entire genus in our fauna.

Thorax oblong, sides arcuate.

Color black, species large (.26 inch)..... subcylindricus.

Thorax wider than long, sides strongly arcuate.

Color rufo-piceous, species small (.12 inch)..... pinguis.

Thorax conical, sides very feebly arcuate.

Color piceous, species small (.07 inch)..... dubius.

C. subcylindricus, n. sp.

Black, shining, form subcylindrical. Rostrum slightly longer than half the thorax, very feebly arcuate, terete, surface moderately punc-

tured, finely canaliculate and with an impressed puncture between the eyes. Antennæ stout, slightly post-median, club scarcely broader than the funicle. Thorax longer than wide, apex feebly constricted, sides arcuate, base slightly narrower and feebly bi-sinuate, surface convex, coarsely punctured, median line and an oval space on each side in front of middle smooth. Elytra not wider than the thorax, nearly cylindrical, surface striate, striæ moderately deep, moderately coarsely but not serrately punctured, intervals feebly convex, irregularly bi-seriately punctured, at apex more rugulose. Body beneath moderately punctured. Length .26 inch ; 6.5 mm.

This species is the largest of the tribe in our fauna, and besides the characters above given, differs from every other Cossonus in having the inner angle of the tibiæ spiniform. The male before me has the tibiæ sparsely fimbriate within.

One specimen, Delaware.

C. pinguis, n. sp.

Reddish brown or piceous, feebly shining, form moderately robust. Rostrum longer than half the thorax, cylindrical, feebly arcuate, sparsely punctured, between the eyes an elongate impressed point. Thorax as broad as long, anteriorly moderately constricted, sides strongly arcuate, base slightly narrowed, feebly bi-sinuate and with an obsolete impression in front of the scutellum, surface moderately and evenly punctured. Elytra not wider than the thorax, moderately convex, striæ moderately deep, at base punctured but neither coarsely nor closely, punctures at apex obsolete, intervals moderately convex, indistinctly punctulate. Body beneath sparsely punctured. Anterior tibiæ sinuate within. Length .12 inch ; 3 mm.

The eighth stria is slightly oblique and joins the seventh slightly behind the humerus, the interval between the ninth and marginal striæ is reduced to an extremely narrow carina. The union of the striæ 7–8 is an unusual character in *Cossonus*, but is the usual form in *Rhyncolus*.

Occurs in Georgia and Florida.

C. dubius, n. sp.

Reddish brown, feebly shining. Rostrum as long as half the thorax, slightly broader at tip, sparsely and at base more coarsely punctured. Antennæ median, club oval sub-acute at tip. Thorax slightly longer than wide at base, sides very feebly arcuate and gradually divergent posteriorly, base feebly bi-sinuate, surface moderately convex, coarsely but not densely punctured. Elytra at base slightly wider than the thorax and slightly wider behind, sides straight at apical fourth obliquely narrowed, apex apparently slightly prolonged and obtusely rounded, surface striate, striæ moderately deep and coarsely and sub-seriately punctured, intervals moderately convex, finely uni-seriately punctulate ; outer striæ as in the preceding species. Body beneath coarsely punctured. Length .07 inch ; 1.75 mm.

The third joint of the tarsi is slightly more dilated than the second.

One specimen from Illinois or Missouri.

From the descriptions and remarks on the four last species, it will be seen that each possesses characters more or less at variance with true Cossonus, and it is possible that some might be referred to genera already known, or to new genera. At present I am totally dependant on the books for my knowledge of the Cossonides, and prefer placing these species as at present, until an opportunity is afforded for a direct examination of representatives of genera unknown to me in nature.

PHLŒOPHAGUS Schönh.

Scape of antennæ impinging more or less on the eyes. Rostrum moderately long. Anterior coxæ narrowly separated, prosternum linear. Third tarsal joint moderately dilated and slightly emarginate at tip.

The species representing this genus in our fauna, are closely related in form to the section *Caulotrupis* Woll.

Two species occur.

Body black, thorax densely punctured.

Elytral striæ deep, coarsely serrately punctured.....apionides.

Body reddish-brown, thorax sparsely punctured.

Elytral striæ broad, not deep, punctures coarse not serrate. minor.

Ph. apionides, n. sp.

Black, moderately shining, form recalling *Apion*. Rostrum as long as half the thorax, very feebly arcuate, cylindrical, slightly flattened at apex, moderately punctured. Thorax very little longer than wide, very slightly narrowed at apex, sides moderately arcuate, base very feebly bi-sinuate, disc convex, coarsely and closely punctured. Elytra broader than the thorax, sides feebly arcuate, apex slightly prolonged and obtusely rounded, surface convex, deeply and rather broadly striate, striæ as deep at apex as at base, coarsely and serrately punctured, intervals narrower than the striæ, convex and slightly irregular on their summits. Body beneath coarsely and densely punctured. Length .12 inch ; 3 mm.

The aspect of this species is that of an *Apion*. The lateral striæ are entire, and not abbreviated behind the humeral prominence.

One specimen in the cabinet of Mr. H. Ulke, collected in Pennsylvania.

Ph. minor, n. sp.

Reddish-brown or somewhat paler, shining. Rostrum half the length of the thorax, stout, not arcuate, sparsely punctured. Thorax slightly longer than wide, sides moderately arcuate, and gradually broader behind the middle, base narrower and very feebly bi-sinuate, disc convex, coarsely and evenly, but not densely punctured. Elytra wider than the thorax, sides parallel, apex broadly rounded, surface convex, striate, striæ not deep and gradually feebler to apex, coarsely but not serrately punctured, becoming obsolete toward apex, intervals feebly convex, uniseriately punctulate. Body beneath sparsely punctured. Length .08 inch ; 2 mm.

The eighth stria is slightly oblique, and joins the seventh behind the humerus.

Widely distributed but not common, occurs in Pennsylvania, District of Columbia and Nebraska (Ulke).

RHYNCOLUS Germ.

Rostrum slightly longer than the head, robust, not or very feebly arcuate. Antennæ robust, scape unusally short, not impinging on the eyes, joints of funicle transverse, club not very abruptly formed. Anterior coxæ distant.

Our species are all of moderately elongate, sub-cylindrical form, and are distinguished in the following manner :

Anterior coxæ distant, as widely separated as the diameter of the coxal cavity.
  Form linear, body beneath sparsely punctured; lateral striæ entire..... protractus.
Anterior coxæ not widely separated, prosternum frequently linear.
  Funicle of antennæ very stout, second joint very short, joints 2–7 very transverse.
    Elytra deeply striate, punctures coarse and serrate.....oregonensis.
  Funicle moderately stout, second joint at least as long as the third, joints 2–7 moderately transverse; elytra feebly striate.
    Rostrum slightly flattened, more or less sulcate.
      Species .14 inch; first two ventral segments very densely and coarsely punctured..... brunneus.
      Species .10 inch; first ventral very sparsely punctured, second nearly smooth..... dorsalis.
    Rostrum convex, not sulcate.
      Species .08–.10; first two ventral segments with coarse sparse punctures..... angularis.

R. protractus, n. sp.

Form slender elongate, piceous, moderately shining. Rostrum narrower than the head, and slightly longer, surface moderately punctured, feebly convex, not sulcate. Eyes moderately prominent. Funicle of antennæ moderately stout, second joint equal to the third. Thorax slightly longer than wide, narrower in front than behind, sides very feebly arcuate, base slightly narrowed and feebly arcuate, surface moderately convex, sparsely and not coarsely punctured. Elytra broader than the thorax, and more than twice as long, sides parallel, slightly narrowed to apex, surface moderately convex, discal striæ nearly obsolete, lateral striæ more distinct and entire, striæ moderately punctured, discal intervals flat, transversely wrinkled, lateral intervals slightly convex. Body beneath sparsely punctured. Anterior coxæ distant. Legs rufous. Length .10 inch; 2.5 mm.

Easily known by its more slender form, distant front coxæ and the entire lateral striæ.

Occurs at Fort Tejon, California, under oak bark.

R. oregonensis, n. sp.

Sub-cylindrical, piceous black, feebly shining. Rostrum slightly longer than the head, moderately convex, coarsely punctured with short median smooth space. Eyes moderately prominent. Funicle of antennæ stout, joints short transverse, second joint shorter than the third. Thorax slightly longer than wide, slightly narrower in front, apex feebly constricted, sides feebly arcuate, base slightly narrower and sub-truncate, disc moderately convex, coarsely and evenly but not very closely punctured. Elytra scarcely wider than the thorax, sides parallel, apex obtusely rounded, surface convex, deeply striate, 7 and 8 confluent behind the humerus, striæ coarsely and serrately punctured, intervals narrow moderately convex, at summit slightly crenulate. Body beneath coarsely and moderately densely punctured, first ventral segment at middle densely and moderately finely punctured. Anterior coxæ approximated. Legs rufous. Length .12 inch ; 3 mm.

Occurs in Oregon. The second joint of the funicle is so short and difficult to see that I was at first inclined to place the species in *Hexarthrum*.

There are some specimens in the cabinet of Mr. Ulke, collected in North Carolina and District of Columbia, differing in having a slight transverse impression of the rostrum and an obsolete fovea between the eyes. They do not appear to differ otherwise, and I cannot feel warranted in assigning them specific rank.

R. brunneus Mann. Bull., Mosc., 1843, II., p. 295 ; Schönh., Gen. Curc. VIII., 2, p. 280.

Sub-cylindrical, piceous or black, feebly shining. Rostrum, slightly narrower than the head and scarcely longer, moderately densely punctured, at middle slightly canaliculate and near the tip a feeble triangular impression. Eyes feebly prominent. Second joint of funicle as long as the third. Thorax longer than wide, slightly narrower in front, with a very feeble constriction, sides moderately arcuate, base slightly narrower and sub-truncate, disc moderately convex, coarsely and deeply but not densely punctured. Elytra slightly wider than the thorax, moderately convex, parallel, apex gradually narrowed, surface striate, lateral striæ feebler, 7–8 confluent, striæ coarsely but not serrately punctured, intervals slightly transversely wrinkled, finely and distantly uni-seriately punctulate. Body beneath coarsely punctured, first ventral segment at middle very densely. Legs rufo-piceous. Length .14 inch ; 3.5 mm.

I have before me typical specimens from Mannerheim. A Vancouver specimen differs from the above description in having the thorax densely punctured and the sulcus of the rostrum reduced to a slight fovea near the tip.

Occurs at Sitka, Vancouver, Canada, Vermont.

R. dorsalis Lec. Proc. Acad., 1858, p. 81.

Piceous, shining, sub-cylindrical. Rostrum scarcely narrower than the head and not longer, surface moderately convex, not densely punc-

tured, along the middle feebly canaliculate. Eyes feebly prominent. Thorax slightly longer than wide, sides nearly straight, feebly divergent behind, base slightly narrower, sub-truncate, disc moderately convex, not densely and moderately finely punctured. Elytra slightly wider than the thorax, parallel, apex broadly rounded, surface moderately convex feebly striate, striæ with moderately coarse but not serrate punctures, intervals nearly flat, the sutural with a single row of fine punctures. Body beneath sparsely punctured, first abdominal segment very sparsely punctured, second with a fine row of punctures at both margins. Legs rufo-piceous. Length .10 inch; 2.5 mm.

One specimen, San Diego, California.

R. angularis Lec. Proc. Acad., 1858, p. 81.

This species reproduces the preceding in form and sculpture and differs as follow:

Rostrum not canaliculate, near apex a very slight fovea. Elytra slightly more robust, punctures coarser. Body beneath more closely punctured. Length .08–.10 inch; 2–2.5 mm.

Occurs on the Colorado Desert, under willow bark.

R. corticalis Boh. Schönh., Gen. Curc. VIII., 2, p. 284.

"Elongatus sub-depressus, rufo-ferrugineus, nitidus, glaber; antennis pedibusque dilutioribus, oculis nigris; rostro capite nonnihil longiori, valido, parum arcuato; thorace oblongo, anterius angustato, sat crebre evidenter punctulato, dorso obsolete longitudinaliter impresso; elytris mediocriter punctato striatis, interstitiis subconvexis lævibus."

Form and appearance of (*Cossonus*) *pallidus*, but one-half longer.

Carolina. Unknown to me. The longitudinal impression of the thorax is a character unknown to me in any of our species.

HEXARTHRUM Woll.

Funicle of the antennæ with six joints.

H. Ulkei, n. sp.

Piceous, moderately shining, subcylindrical. Rostrum narrower and longer than the head, moderately densely punctured. Eyes flat. Thorax as wide as long, slightly narrower in front, sides feebly arcuate, base slightly narrower and sub-truncate, disc moderately convex, coarsely and sparsely punctured. Elytra slightly wider than the thorax, cylindrical, surface feebly striate, striæ with coarse punctures, closely placed but not serrate, intervals flat, each with a single series of fine punctures. Body beneath coarsely but sparsely punctured. Anterior coxæ closely approximated. Length .10 inch; 2.5 mm.

The antennæ are more slender than in *Rhyncolus*, and reproduce exactly the figure given by Wollaston. Trans. Ent. Soc. Lond. n. s. V., pl. 18, fig. 2.

One specimen, District Columbia (Ulke).

STENOSCELIS Woll.

I refer with doubt the following species to this genus. The rostrum is very short, narrower than the head. Club of antennæ round, flattened slightly. The lateral processes of the submentum are more prominent than usual in the preceding genera, and are distinctly visible from above.

S. brevis Boh. Schön. Gen. Curc. VIII., 2, p. 282.

Robust, cylindrical, brownish or black, feebly shining. Rostrum short, narrower than the head, moderately coarsely and densely punctured. Thorax broader than long, broadly constricted in front, sides feebly arcuate, base slightly narrower, disc convex, coarsely and densely punctured. Elytra cylindrical, parallel, obtusely rounded at apex, surface striate, striæ broad, coarsely and serrately punctured, intervals narrower, feebly convex at summit, uneven and with a series of fine punctures distantly placed. Body beneath coarsely and sparsely punctured. Length .12 inch; 3 mm.

Described by Boheman as *Rhyncolus*. Resembles *Hylastes* in form, and also, from the figure, *Stenoscelis hylastoides* Woll. (Journ. Ent. Vol. I., pl. XI., fig. 1), except that the sides of the thorax are more nearly parallel at middle, and the basal angles rounded.

Occurs from New York to Florida.

To this genus the following probably belongs:

Rhyncolus latinasus Say. Desc. Curc. N. A. p. 30; Am. Ent. edit. Lec. I., p. 299; Boh. Schönh. Gen. Curc. IV., p. 1068.

"Subdepressus, niger, glaber, antennarum clava pedibusque rufo-ferrugineis; rostro brevi latitudine fere capitis, sublineari, thorace oblongo profunde sub-disperse punctato, obsoletissime carinato; elytris rufo-castaneis, confertim punctato striatis, interstitiis angustis, convexis."

Front with slight fovea. Apical margin of thorax slightly elevated at middle. Length .10 inch (Say).

Occurs in Florida. Unknown to me.

———:o:———

ITHYCERUS Schön.

I. noveboracensis Forst. Nov. Spec. Ins. 1771, p. 35; *curculionoides* Herbst, Käfer VII, p. 136, pl. 105, fig 1; Gyll. Schön. Gen. Curc. 1, p. 246: *punctulatus* Fab. Ent. Syst. 1, 2, p. 461; *Schönherri* Kby. Fauna Bor. Am. IV, p. 271.

Male. Abdomen *apparently* with six segments.

The sixth segment is really the pygidium which projects beyond the corresponding ventral segment, its lower margin being thickened and simulating in its construction a true ventral segment. The anal opening may be seen in the suture between it and the fifth ventral. The latter segment is shorter than those which precede and its posterior margin straight. The dorsal segments of the abdomen are eight in number.

Female. Abdomen with five segments.

The terminal ventral segment is longer than either of the two preceding and oval at tip. The dorsum of the abdomen has seven segments only.

Lacordaire (Genera VI, p. 12) mentions the occurrence of six ventral segments in the specimen before him but failed to recognize the nature of the terminal segment, and having probably only males before him failed to recognize its sexual nature. The projection of the pygidium in the manner indicated is by no means rare in its occurrence, and I have seen it in *Balaninus*, *Orchestes* and many *Centorhynchidæ* but in a much less marked degree than we see it in *Ithycerus*. The apparent reduction of the number of the segments by the entire obliteration of a suture, usually the first, has also been noticed.

Ithycerus occurs from Canada to Texas. The southern specimens are less densely pubescent in the spaces between the short lines of white pubescence, so that the latter are more strongly marked by contrast. Its habits have been fully elucidated by Mr. C. V. Riley in the "Third Annual Report on the Noxious, Beneficial and other Insects of Missouri," 1871, p. 57.

OTIDOCEPHALUS Chev.

The peculiar Ant-like form of the species of this genus renders it easily known. All our species except one, have the femora toothed and are known as follows:

Femora toothed.
  Thorax cylindrical, not constricted at base.
    Elytra densely clothed with white pubescence with four glabrous lines on each..... vittatus.
    Elytra moderately densely clothed, pubescence in tufts, surface faintly bronzed..... Ulkei.
  Thorax anteriorly broader and more convex, at base constricted.
    Femora very strongly toothed; elytra with moderately coarse punctures..... ..... myrmex.
    Femora with a small very acute tooth.
      Elytra striate, striæ coarsely punctured; thorax densely and coarsely punctured..... scrobicollis.
      Elytra with rows of moderately fine punctures.
        Thorax sparsely punctured, elytra broadly oval, gibbous ..... Chevrolatii.
        Thorax smooth, elytra oblong oval, moderately convex..... lævicollis.
Femora not toothed and more slender.
  Thorax coarsely, deeply and evenly punctured, hairs white ..... perforatus.

O. vittatus n. sp.

Form moderately elongate. Rostrum vertical, nearly cylindrical, slightly broader towards the tip, moderately punctured, at apex sparsely, at base

more densely clothed with white pubescence. Head moderately densely punctured, densely clothed with white pubescence except on the occiput. Eyes moderately distant. Thorax cylindrical, one-fourth longer than wide, sides very feebly arcuate, at base scarcely sinuate, convex, moderately coarsely and densely punctured and clothed with white pubescence, median line slightly elevated, smooth and shining. Scutellum densely clothed with white. Elytra broader at base than thorax, oblong, subcylindrical scarcely broader behind, surface densely clothed with white recumbent pubescence (sparsely along the suture) and with four narrow glabrous lines on each elytron, the pubescent spaces moderately densely and finely punctured, the glabrous lines with a row of moderately fine and distant punctures each bearing an erect black hair. Body beneath moderately densely punctured, sparsely pubescent and with a dense narrow line of white pubescence along the side of the body extending to the tip of the abdomen. Legs sparsely pubescent with recumbent hairs with erect hairs intermixed. Length .26–.30 inch ; 6.5–7.5 mm.

Beneath the pubescence the entire body is black and shining. The femora have a minute tooth. Evidently allied to *O. pelliceus* Rosen.

Three specimens from Owen's Valley, California.

O. Ulkei n. sp.

Body black with very faint tinge of bronze. Rostrum vertical, sparsely punctured at tip, obtusely carinate, on each side bisulcate, sulci coarsely punctured and nearly confluent opposite the scrobe, surface sparsely pubescent. Head very coarsely and deeply and moderately densely punctured, sparsely cinereo-pubescent. Thorax cylindrical, at basal third moderately sinuate, surface convex, very coarsely and deeply and sub-confluently punctured on the disc, less densely on the sides, moderately densely pubescent, a narrow line along the middle and sides paler, pubescence arranged in small tufts and composed of dark cinereous and white hairs intermixed and with erect white hairs very sparsely placed, directed anteriorly. Scutellum pubescent with white. Elytra oblong oval, sides slightly compressed, surface with rows of moderate punctures replacing the striæ, two lateral rows striate, intervals sparsely punctured, each puncture with a tuft of recumbent hairs as on the thorax and with short erect white hairs sparsely placed, pubescence along the suture paler. Body beneath and legs black, shining, sparsely punctured and pubescent similarly to the upper surface but paler. Femora with a minute tooth. Length .26 inch ; 6.5 mm.

This species is so distinct from any other in our fauna that it is hardly necessary to add to the above description. The general aspect of the species is that of being moderately densely pubescent. The pubescence arises from the sparse punctures of the intervals and forms fan-like tufts, always recumbent composed of darker cinereous hairs intermixed with a few white ones.

One specimen in the cabinet of Mr. H. Ulke, by whom it was obtained from Lower California.

O. myrmex Hbst. Käfer, VII, p. 56, pl. 99, fig. 7; *myrmecodes* Say, Curc. N. A. p. 15; Ann. Ent. ed. Lec. I, p. 278; *americanus* Chev. Ann. Ent. Soc. N. 1832, p. 105, pl. 3. fig, 3; Gyll. Schön, Gen. Curc. III, p. 366; Rosensch. loc. cit. VII, 2, p. 205.

Body oblong, slightly compressed, black, shining. Rostrum cylindrical, at base moderately punctured, sulcate, two sulci on the upper surface short, basal, between them a slight carina, on each side a longer sulcus extending from opposite the insertion of the antennæ to base. Head very coarsely but sparsely punctured. Thorax obovate, strongly convex, sides arcuate, base narrowed, surface smooth at the sides, coarsely punctured along the middle especially toward the apex and base, and with sparsely placed black, suberect hairs, pointing anteriorly. Scutellum small with white pubescence. Elytra oblong, broader at apical fourth, convex, slightly compressed, humeri slightly oblique, surface shining with rows of moderate punctures replacing the striæ, intervals with a series of finer, distant punctures each bearing a short erect hair. Body beneath black shining, with a narrow line at the sides of moderately dense cinereous pubescence extending to the tip of the abdomen, pectus smooth, abdomen sparsely punctured. Legs black, sparsely pubescent with cinereous. Femora with a large, triangular, acute tooth, tibiæ slightly broader below the middle. Length .16–.18 inch; 4–4.5 mm.

This species is known in all collections as *scrobicollis*, and while it is undoubtedly the *americanus* it is none the less *myrmex*, and it is remarkable that no author, Say excepted, has recognized this fact. The large tooth of the femora at once fixes this as the insect intended by all the authors above cited.

Occurs from Pennsylvania westward and to Georgia.

O. scrobicollis Boh. Schön. Gen. Curc. VII, 2. p. 205.

Similar in form and appearance to the preceding. Rostrum similar. Head densely and coarsely punctured. Thorax obovate; convex pilose as in *myrmex*, sides arcuate, base strongly narrowed, surface coarsely, deeply and densely punctured on the disc, more sparsely at the sides. Scutellum cinereo-pubescent. Elytra oblong-ovate, strongly convex, striate, striæ moderately coarsely and sub-serrately punctured, intervals slightly convex, with a single row of fine punctures each bearing an erect hair, either cinereous or black. Body beneath black, shining, sparsely punctured and with a cinereo-pubescent line at the sides. Legs sparsely punctured, black, with erect hairs either cinereous or black. Femora with a minute, acute tooth, tibiæ as in *myrmex*. Length .16 inch; 4 mm.

I have seen but one specimen of this species, captured by Dr. John W. Eckfeldt in Delaware County, Pennsylvania. By a casual examination it might be confounded with *myrmex*, but the very densely punctured thorax and small femoral tooth at once distinguish it.

O. Chevrolatii Horn; *myrmecodes* ‖ Chev. Ann. Ent. Soc. Fr. 1832 p. 445.

Black, shining. Rostrum smooth shining, above very slightly canali-

culate near the tip, obtusely carinate to base, on each side two coarsely punctured sulci which coalesce opposite the scrobes and continue nearly to tip. Head sparsely and moderately coarsely punctured, between the eyes a deep fovea. Thorax obovate, convex, sides arcuate base narrower, surface very sparsely and moderately coarsely punctured over the entire surface. Scutellum densely cinereo-pubescent. Elytra broadly oval, very convex, humeri obliquely rounded, surface smooth, shining, with rows of moderately fine punctures, the outer two rows striate, intervals flat with a single row of very minute distantly placed punctures each bearing a short erect hair. Body beneath black, shining, sides of pectus with a narrow cinereo-pubescent line. Legs as in the preceding. Femora with a very minute acute tooth. Length .16 inch ; 4 mm.

The sparsely punctured thorax, strongly arched elytra, deeply foveate front and more sparsely pilose surface, at once distinguish this species.

Rare in the Middle States.

This species is not the *myrmecodes* Say as the Catalogus of Gemminger and Harold would seem to indicate. The name given by Chevrolat being preoccupied, it gives me pleasure to dedicate it to the latter author.

O. laevicollis n. sp.

Black, shining. Rostrum sulcate at the sides in front above the scrobes, above not carinate. Front moderately prominent, between the eyes narrow. Head sparsely punctured. Thorax obovate, convex, sides arcuate base narrower, surface smooth shining, impunctured, or with a very few punctures near the apex at the sides. Scutellum cinereo-pubescent. Elytra oblong oval, moderately convex, smooth shining, with rows of fine moderately distant punctures, the outer two rows slightly striate, intervals flat with a single series of very distant, minute piliferous punctures. Body beneath and legs as in the preceding species. Length .16 inch ; 4 mm.

By its comparatively smooth elytra, this species resembles the preceding but differs greatly in the form of that part. The thorax is very smooth above and very sparsely pilose. The rostrum is apparently broader (in a vertical direction) and the sides at base much flatter and the scrobes therefore more oblique. The front between the eyes is narrow and the latter more prominent than usual, and the head therefore more convex than any other species.

One specimen Georgia and two from unknown localities.

O. perforatus n. sp.

Piceous, shining. Rostrum moderately stout, coarsely but irregularly punctured, grooves obsolete, above subcarinate. Eyes moderately prominent. Head coarsely and deeply but sparsely punctured and between the eyes a more distinctly impressed puncture. Thorax obovate, moderately convex, sides moderately arcuate and in front of base slightly sinuate, surface coarsely, very deeply, evenly but not densely punctured over the entire disc and sides, and with a very few short, slender, white, recumbent

hairs. Scutellum minute. Elytra elongate oval, broadest at middle, moderately convex and with rows of feeble distantly placed punctures becoming obsolete towards the apex, intervals with very minute distant punctures, each bearing a slender white recumbent hair. Pectus beneath with a cinereo-pubescent line near the elytral edge, surface nearly impunctured, smooth shining. Femora slender mutic. Length .14 inch; 3.5 mm.

The femora of this species are much more slender than is usual and absolutely devoid of any tooth, and the anterior pair merely very feebly sinuate. One of the most distinct species in our fauna.

One specimen in the cabinet of Mr. H. Ulke, collected in Maryland.

I have not been able to determine, with the specimens at my disposal, whether the sexes are distinguished by the presence of the additional dorsal segment in the male. It is however probable that as in the greater number of *Mecorhynques* which I have examined, the males have 8 and the females 7 dorsal ventral segments.

Magdalis Germ.

Our species are few in number and represent all the groups into which the genus has been divided. Four species have simple ungues and two of these have unarmed femora, and all have the thorax without anterior serrature or spines.

The sexual characters are remarkable. The males have the dorsum of the abdomen with eight segments, the females have one less. This results from the union of the last two dorsal segments so that the female has apparently a much larger pygidium than the male. The pygidium of the male is short, twice broader than long. The antennæ of the males are inserted near the tip of the rostrum and in the females very slightly in front of the middle, the rostrum in the males being slightly dilated at tip. Both these latter characters suffer an exception in *M. Lecontei*, as in both sexes the rostrum is similar and the antennæ inserted slightly behind the middle. This might constitute a distinct genus.

As far as known our species are as follows:

Claws simple. Thorax in front not serrate.
- Femora mutic.
  - Body black, elytra with very coarse punctures..... perforata.
  - Body blue, elytra with moderately fine punctures..... cuneiformis.
- Femora dentate.
  - Body blue, thorax widest at base..... Lecontei.
  - Body brown, thorax not wider at base than at middle. imbellis.

Claws toothed at base. Thorax serrulate or dentate.
- Mesosternum protuberant. Head elongate conical.
  - Scape of antennæ not attaining the eyes..... barbita.
- Mesosternum not protuberant, scape of antennæ passing the eyes.
  - Body above totally black.
    - Hind angles of thorax feebly laminiform, disc densely punctured.

Elytra deeply striate, intervals convex.	
Tibiæ, tarsi and antennæ pale piceo-testaceous..	olyra.
Tibiæ black, antennæ and tarsi piceous.	
Head broadly conical, eyes moderately convex, scutellum densely clothed with white pubescence.....	gracilis.
Head elongate conical, eyes flat, scutellum feebly pubescent.....	salicis.
Elytra feebly striate, intervals flat.....	inconspicua.
Hind angles broadly laminiform, covering the entire base of the elytra, disc sparsely punctured, opaque,	pandura.
Body above and beneath ferruginous.....	armicollis.
Body piceous or nearly black, elytra pale ferruginous.....	pallida.

The species of this genus have been for the most part described under the generic names *Thamnophilus* and *Magdalinus*.

M. perforata n. sp.

Black shining. *Female.* Rostrum cylindrical arcuate, moderately punctured, median line at base smoother. Antennæ median, piceous, scape attaining the eyes. Head broadly conical, moderately punctured, eyes flat. Thorax longer than wide, sides in front gradually arcuate, posteriorly nearly parallel, not sinuate, base strongly bisinuate, disc moderately coarse and shining, coarsely, densely and deeply cribrato-punctate. Scutellum small, smooth. Elytra gradually wider behind, at basal margin slightly impressed, surface with striæ of large deep quadrate punctures separated by extremely narrow spaces, intervals narrow, uniseriately punctate. Pygidium coarsely and deeply punctate. Body beneath black, coarsely and densely punctured, abdomen more sparsely punctured. Legs black, femora mutic, the anterior femur impressed near the base. Length .20 inch ; 5 mm.

Has somewhat the aspect of a Cossonus. Tarsal claws simple.

Occurs in Georgia.

M. cuneiformis n. sp.

Elongate, cuneiform, surface blue, shining. Rostrum moderately arcuate, sparsely punctured, more densely near the base. Head broadly conical, sparsely punctured, slightly impressed between the eyes. Thorax longer than wide at base, anteriorly broadly but feebly constricted, sides straight divergent, hind angles moderately prominent and (viewed from above) truncate at tip, base deeply bisinuate, surface moderately convex, deeply and densely punctured. Elytra scarcely wider at base than the thorax, sides gradually divergent, at apical third arcuately narrowing, surface moderately convex, base slightly impressed, and with rows of moderate punctures in obsolete striæ, intervals flat, biseriately punctulate. Pygidium black, shining, coarsely punctured. Body beneath blue, shining, moderately coarsely and densely punctured. Legs sparsely

punctured, bluish. Femora mutic, the anterior stouter, compressed at base and with a deep oblique impression. Length .28 inch ; 7 mm.

This species resembles the following, but differ in its mutic femora, more slender form and elytral sculpture. The anterior femora are stouter than the others and more decidedly compressed, and with a deep oblique groove near the base forming an equilateral triangle with the suture between the femur and trochanter and the upper edge of the femur, and causing the appearance of there being two trochanters.

One specimen from Nebraska in the cabinet of Mr. H. Ulke.

M. Lecontei, n. sp.

Bluish green, varying to bronze, thorax somewhat darker. Rostrum black, cylindrical, sparsely punctulate, between the eyes slightly impressed. Antennæ slightly post-median. Head oval, eyes moderately prominent. Thorax broader than long, sides moderately arcuate, near the base slightly sinuate, hind angles moderately produced, acute, base bisinuate, disc convex, densely punctured, median line smoother and a slight impression in front of the scutellum. Elytra slightly broader behind, at base slightly impressed, surface with striæ of moderate punctures, intervals flat, finely transversely strigose and a single row of moderate punctures. Pygidium moderately coarsely punctured. Body beneath slightly darker in color than above, sides piceous cinereo-pubescent, surface moderately densely, the abdomen more finely, punctured. Legs black, femora dentate. Length .20–.26 inch ; 5-6.2 mm.

The rostrum of the male is slightly shorter and less arcuate than the female. Tarsal claws simple.

Occurs from Kansas to Oregon and California. I have also a specimen from South Carolina, smaller and more blue than the Western forms, which I cannot at present separate.

M. imbellis Lec. Pacif. R. R. Rep. 1857, App. I, p. 57.

Reddish brown, sub-opaque, metathorax and abdomen piceous. Rostrum sparsely punctured, antennæ slightly ante-median, ferruginous. Head oval densely punctured, eyes moderately prominent. Thorax broader than long, scarcely constricted in front, sides strongly arcuate, at base sinuate, hind angles moderately prominent, base bisinuate, surface moderately convex, very densely and rather coarsely punctured, narrow median line smooth. Elytra slightly broader behind, base feebly impressed, surface deeply striate, striæ coarsely punctured, intervals flat, moderately coarsely rugulose. Pygidium moderately coarsely punctur.d. Body beneath coarsely sub-obsoletely punctured, abdomen finely and sparsely punctured. Legs reddish brown, femora dentate, tarsal claws simple. Length .20 inch ; 5 mm.

Easily known by its color, simple claws and not denticulate thorax.

One specimen ♀ Oregon.

M. barbita Say. Curc. N. A. 1831, p. 6 ; Am. Ent. ed. Lec. I, p. 265 ; Gyll. Schön. Gen. Curc. III, p. 271.

Black, subopaque. Rostrum nearly as long as head and thorax, sparsely punctured. Antennæ piceous. Head elongate conical, moderately densely punctured, eyes feebly prominent. Thorax longer than wide, anteriorly feebly constricted, sides feebly arcuate, base narrower, at middle broadly arcuate, on each side very slightly sinuate, hind angles not laminiform, disc moderately convex, near the anterior angles a short spine and several serrations, surface densely punctured with median line smoother. Scutellum densely clothed with white pubescence. Elytra slightly broader behind, base scarcely impressed, surface deeply striate, striæ coarsely punctured, intervals convex, transversely wrinkled. Pygidium densely punctured and opaque. Body beneath densely, abdomen more sparsely and finely punctured. Mesosternum protuberant in front. Legs black. Length .14–.24 inch ; 3.5–6 mm.

Male. Rostrum shorter, less arcuate, slightly dilated at tip. Antennæ inserted near the tip of rostrum, scape (♂ ♀) not attaining the eyes.

The males are smaller than the opposite sex. Resembles *olyra* in appearance, but differs in form of head, length of scape and protuberant mesosternum.

Occurs in Canada, Pennsylvania, Georgia, Dakota.

M. olyra Herbst. Käfer. VII, p. 6, pl. 99, fig. 1 ; Boh. Schönh. Gen. Curc. VII, 2, p. 140 ; *brunnipes* Gyll. Schönh. Gen. Curc. III, p. 270.

Closely resembles the preceding. Differs as follows: Hind angles of thorax feebly laminiform. Mesosternum not protuberant. Head very broadly conical. Antennæ, tibiæ and tarsi pale piceo-testaceous. Length .16–.24 inch ; 4–6 mm.

Antennæ inserted as in *barbita*, the scape barely attaining the eyes in ♀ but passing them ♂.

Occurs with the preceding, but rarely in the Southern States.

M. gracilis Lec. Pacif. R. R. Rep. 1857, App. 1, p. 57.

Black, subopaque. Head rather broadly conical, eyes convex. Thorax slightly wider than long, hind angles not prominent, disc densely punctured, punctures shining at bottom. Scutellum densely clothed with white pubescence. Elytra scarcely wider behind, base feebly impressed, deeply striate, striæ coarsely punctured, intervals narrower than the striæ, convex, rather coarsely transversely strigose. Pygidium coarsely granulato-punctate. Body beneath coarsely punctate, abdomen shining, very sparsely and finely punctulate. Antennæ piceous, legs black. Length .14 inch ; 3.5 mm.

The characters otherwise are as in *barbita* without the prominent mesosternum. The head is more conical than in *olyra* without being of the form of *barbita* and *salicis*.

Occurs in California.

M. salicis n. sp.

Differs from *olyra* as follows : Head elongate conical. Thorax more coarsely and equally densely punctured. Scutellum without white pubes-

cence. Antennæ dark piceous or black, tibiæ and tarsi black. Length .12–.16 inch ; 3–4 mm.

The form of the head and the coarser punctuation of the thorax distinguish this species from both those which precede.

Occurs in the Middle States.

M. inconspicua n. sp.

Similar in form to *elyra* but smaller. Head broadly oval. Thorax as broad as long less densely punctured anteriorly. Scutellum small, black. Elytral striæ feebly impressed, punctures moderate, not serrate, intervals flat and finely transversely strigose. Pygidium rufo-piceous, punctato-granulate. Body beneath coarsely but not densely punctured, abdomen more shining, sparsely and finely punctulate. Length .14 inch ; 3.5 mm.

Easily known from every other species with dentate claws by the flat interstices and feebly impressed striæ. The three outer striæ are deeper.

One specimen, Pennsylvania.

M. pandura Say. Curc. N. A. p. 7 ; Am. Ent. ed. Lec. I, p. 265 ; Gyll. Schönh. Gen. Curc. III, p. 268.

Black, opaque. Rostrum sparsely punctulate and finely alutaceous. Head sparsely punctulate, finely alutaceous and slightly grooved between the eyes. Thorax slightly broader than long, anteriorly rather suddenly narrowed, spine and denticulations nearer the middle than the apex, sides feebly arcuate, base not narrower, hind angles laminiform, covering the entire elytral base, surface sparsely and moderately coarsely punctured, intervals opaque, alutaceous. Scutellum black. Elytra moderately robust, moderately deeply striate, striæ coarsely punctured, intervals feebly convex, finely transversely wrinkled. Pygidium coarsely punctato-granulate. Body beneath black, moderately coarsely punctate, abdomen finely alutaceous, subopaque, sparsely punctate. Legs black. Length .10 inch ; 2–5 mm.

Differs from all the species by its small size, more robust form, sparsely punctured thorax and the broadly dilated laminiform hind angles of thorax. The thoracic serrate space is nearer the middle than in any species.

Occurs in Pennsylvania, Georgia, Missouri.

M. armicollis Say. Journ. Acad. III, 1823, p. 312 ; Boh. Schönh. Gen. Curc. VII, 2, p. 141.

Form of *olyra*. Color pale reddish-brown. Head coarsely and densely punctured. Thorax granulato-punctate, serrations feeble, form subquadrate, sides feebly arcuate not sinuate posteriorly, hind angles scarcely prominent. Elytra deeply striate, striæ very coarsely punctured, intervals narrower, feebly convex, granulate at summit. Pygidium granulate. Body beneath, legs and antennæ pale reddish-brown, punctured as in *barbita*. Length .14–.24 inch ; 3.5–6 mm.

Occurs with *barbita*.

M. pallida Say. Curc. N. A. p. 7; Am. Ent. ed. Lec. I, p. 266.

Body beneath and legs piceous or black, elytra luteous or pale reddish-brown. Thorax coarsely and moderately densely punctured, a fine slightly elevated median line, serratures feeble, sides feebly arcuate at base slightly sinuate, hind angles distinct but not very prominent. Elytra parallel, base feebly impressed, sutural interval slightly elevated at base, surface moderately striate, striæ with coarse but not close punctures, intervals feebly convex, finely alutaceous. Pygidium coarsely punctured. Body beneath and legs black, tarsi piceous, body punctured as in *barbita*. Length .12–.16 inch; 3–4 mm.

Easily known by its coloration.

Occurs in New York, Pennsylvania, Illinois.

The species of Magdalis are all more or less pubescent when recently captured, and the pubescence is so easily removed that but few cabinet specimens retain it, therefore no mention has been made of it in the above descriptions.

Balaninus Germ.

The marked uniformity of vestiture of many of the species renders it extremely difficult to separate them. Fortunately other more prominent characters exist as will be seen in the table given below. As in *Magdalis* the sexes are known by the longer rostrum of the female, which is more slender and less arcuate than in the male. In the latter sex the dorsum of the abdomen has eight segments and in the female seven.

The mandibles of *Balaninus* are incapable of motion laterally, being restricted to a motion in a vertical plane, acting like scissors in which both edges are acute.

In the American Journal of Science and Arts, Vol. XLIV, July, 1867, Dr. Leconte writes as follows, after mentioning the existence in some genera of Coleoptera of corneous exserted ovipositors, "But it was reserved for the Rhynchophora to exhibit a degradation of type, by which a function, peculiarly appropriate to the posterior extremity of the body, is performed by the head; the elongated beak becoming in fact the ovipositor." This appears to me true only so far as the perforation is concerned into which the egg is to be deposited. The beak really perforates the exterior of the acorn or other fruit and the act of oviposition is done by a long ovipositor of slender form and half the length of the body. I have before me a specimen with the ovipositor protuded and an egg seized by its tip.

Our species of *Balaninus* are as follows:

First joint of funicle shorter than the second.
  Each elytron rounded at tip, pygidium in great part visible; ..... caryatrypes.
First joint of funicle longer than the second. Elytra subacute at tip, pygidium feebly exposed.

Pygidium ♂ concave at tip and glabrous, the depression surrounded by moderately long silken hairs..... quercûs.
Pygidium ♂ convex, punctured, hairy.
Thorax longer than wide; tooth of femur small..... rectus.
Thorax wider than long.
Tooth of hind femur small, free edge sinuate..... uniformis.
Tooth of hind femur large, triangular, free edge straight.
Body above and beneath sparsely clothed, with hairs scarcely at all scale-like..... caryæ.
Body above moderately densely, beneath very densely clothed, hairs beneath broad, scaly..... nasicus.

B. caryatrypes Boh. Schönh. Gen. Curc. VII., 2, 276.

Body dark-brown, densely clothed with ochreous scale like hairs, thorax at middle broadly fuscous, elytra with fuscous spots irregularly, but closely placed. Rostrum at base punctured. Second joint of funicle longer than the first. Thorax not longer than wide at middle, apex half the width of base, sides in front rapidly diverging, then arcuate and very slightly narrowed to base; base on each side very feebly sinuate; disc convex coarsely and densely punctured, median line smooth, surface clothed with ochreous scale-like hairs with broad space at middle (except fine median pale lines), and sides fuscous. Elytra oval, emarginate at base, apices obtusely rounded, disc anteriorly slightly depressed, surface striate, striæ punctured, intervals flat, densely rugosely punctulate, surface clothed with ochreous scale-like hairs, interspersed with brownish spots. Pygidium densely and coarsely punctured. Body beneath densely clothed with pale yellow silken scales. Legs pale rufo-testaceous, sparsely clothed with silken yellow, short hairs. Femora with a broad triangular tooth, the apex of which is more acute and directed outwards. Length (excluding rostrum) .32–.44 inch; 8–11 mm.

Male.—Rostrum shorter, not longer than the entire body, gradually arcuate, nearly from the base. Dorsum of abdomen with eight segments. Pygidium with moderately long silken hairs.

Female.—Rostrum often nearly as long as twice the body, straight at basal three-fourths, arcuate at tip. Pygidium scarcely exposed, with short sparse pubescence. Dorsum of abdomen with seven segments.

This is our largest species, said to live on the chestnut. The color of the elytral pubescence is occasionally uniform. The femora near the tip are very deeply sinuate so that I have described them as being strongly toothed, taking the triangular prominence as a tooth, which is, however, suddenly more slender at apex, and directed outwards toward the apex.

Occurs from the Middle States, westward.

B. quercus, n. sp.

Body brownish, clothed with pale-brown scale-like hairs, nearly uniform on the thorax, elytra moderately closely spotted with pale orange

rarely confluent into short transverse lines. Thorax one-third wider than long, sides moderately strongly arcuate, surface densely punctured, very sparsely pubescent, slightly denser along the median line. Elytra oval, gradually attenuate to tip, disc moderately convex, striate, striæ punctured, intervals densely, but not roughly punctured, surface moderately densely clothed with pale-brown, with numerous pale-orange spots, sometimes confluent into short fasciæ. Body beneath moderately densely clothed, paler than above. Femora dentate as in *caryatrypes*. Tarsal claws with the basal appendix narrow.

Male.—Rostrum slightly shorter than the body, moderately arcuate. Abdomen with eight segments above, pygidium at tip deeply concave, the concavity smooth, shining and surrounded by an acute rim fimbriate with long hairs.

Female.—Rostrum longer than the body. Abdomen above with seven segments, pygidium fimbriate, convex.

This species is abundantly distinct by the sexual characters.

There are numerous specimens before me reared by Mr. John Akhurst, of Brooklyn, N. Y., and one from Texas, from M. Sallé (No. 65).

B. rectus Say. Curc. N. A., p. 16;* Am. Ent. edit. Lec. I, p. 279; *rectirostris* Gyll. Schönh. Gen. Curc. III., p. 376; *Sayi*, Gyll. loc. cit. p. 375.

Form moderately slender, color piceous, clothed with brownish scale-like hairs, elytra with numerous pale-yellow spots, more or less confluent. Thorax longer than wide, more or less conical, sides very feebly arcuate or nearly straight from apex to base, surface moderately convex, densely punctured, median line slightly elevated, smooth, clothed with brownish hairs with a paler line near the side. Elytra oval, rapidly attenuate to base, surface striate, striæ punctured, intervals flat, densely punctured, densely clothed with brownish pubescence, with numerous pale-yellow spots more or less confluent, sometimes forming fasciæ. Body beneath with paler, more silken scales. Femora with rather strong triangular tooth, slightly sinuous on its distal edge. Claws with moderately broad basal lobe. Length .20–.26 inch; 5–6.5 mm.

Male.—Rostrum shorter than the body, feebly arcuate. Pygidium convex at tip, punctured and pilose.

Female.—Rostrum nearly twice as long as the body, moderately arcuate at tip. Pygidium less pilose.

Occurs in the Middle and Southern States.

B. uniformis Lec. Pacif. R. R. Rep., 1857, p. 57.

Form robust, brownish or piceous, surface moderately densely clothed with scale-like hairs of variable color. Rostrum slender. Thorax wider

* The descriptions given by Say, are absolutely valueless, consequently the descriptions of Gyllenhal from types sent by Say, must be relied on in determining the species of the latter author. This appears to be the species supposed to be *proboscideus* Fab. by Say. As none of Say's types are extant, the only way out of the difficulty appears to be to accept the descriptions of Gyllenhal, and determine synonymy directly from them.

than long, sides (slightly sinuate in front), rather strongly arcuate, base slightly narrower, surface sparsely pubescent. Elytra oval feebly emarginate at base, surface striate, striæ punctured, intervals moderately rugulose. Length .24–.30 inch ; 6–7.5 mm.

Male.—Rostrum nearly as long as the body.

Female.—Rostrum longer than the body.

Variety.—Thorax sparsely pubescent, pubescence cinereous ; elytra sparsely cinereo-pubescent with indistinct brownish spots intermixed.

Variety.—Pubescence of thorax more dense, ochreous, discal space darker ; elytra with ochreous pubescence with darker spots.

Variety.—Pubescence moderately dense, nearly unicolorous, that of the elytra cinereous with slight yellowish tinge.

This species is distinguished rather by negative characters from those which precede and follow. It has an aspect of greater robustness than any species of the genus. The tooth of the former is much smaller, and the free edge is deeply sinuous. From *rectus* it may be at once distinguished by the form of the thorax, from *nasicus* by the form of the elytra and the much more feeble femoral tooth, and from *caryæ* by the tooth of the femur of the latter being very large and triangular, and the tibiæ much more strongly mucronate at tip.

Occurs in Canada, Pennsylvania, Illinois, Texas, Kansas, California and Oregon.

One specimen of the third variety is marked as injuring the Hazel nut.

B. caryæ, n. sp.

Brownish, sub-opaque, very sparsely pubescent above and beneath. Thorax wider than long, sides (in front slightly sinuate), strongly arcuate, disc moderately convex, densely and coarsely punctured, very sparsely clothed with ochreous pubescence. Elytra oval, moderately emarginate at base, moderately convex, striate, striæ punctured, intervals flat, roughly punctured, sparsely pubescent with ochreous hairs. Body beneath sparsely pubescent with hairs that are feebly scale-like, and paler in color than the upper surface. Length .36 inch ; 9 mm.

Sexual characters as in the preceding species.

The femora are armed with a strong triangular tooth, and the tibiæ at tip more strongly mucronate than in any of our other species. Among all the females of the preceding species the hind tibiæ are more evidently sinuous than in the male. This is especially noticeable in this species.

The specimens before me are from Mr. Akhurst, of Brooklyn, and they are known to infest the Hickory nut.

B. nasicus Say. Curc. N A., p. 16 ; Am. Ent. edit. Lec. I., p. 279 ; Gyll. Schönh. Gen. Curc. III., p. 377 ; *nasutus* ‖ Say, loc. cit. ; *rostratus*, Gyll. loc. cit,, p. 374 ; *sparsus* Gyll. loc. cit., p. 379.

This species resembles a small *carytatrypes*, and differs in having the thorax broader, the sides more arcuate. The surface is similarly clothed,

but on the elytra the tendency of the paler pubescence is to form bands. The elytra are triangular, the sides scarcely arcuate and very rapidly narrowing to apex. The femora are armed with a strong triangular tooth, and the tibiæ, especially the posterior, feebly mucronate. Length .24–.30 inch; 6–7.5 mm.

Sexual characters as in *caryatrypes*.

Occurs in Pennsylvania, Illinois, Kansas, Georgia, said to infest acorns and hazel nuts.

Balaninus porrectus Boh. Schönh. Gen. Curc. VII., p. 292.

This does not appear to belong to the genus.

Orchestes Illig.

The form of the hind femora will serve to make this genus readily known, as in nearly all the species they are stout, and enable the species to leap after the manner of the Halticides. Their facies is much that of Apion. Our species are few in number, and are distinguished in the following manner:

Funicle of antennæ six-jointed.
- Body above black, inconspicuously grayish-pubescent, legs black, tarsi and antennæ pale, rufo-testaceous.... pallicornis.

Funicle of antennæ seven-jointed.
- Body above black without conspicuous pubescence; scutellum densely clothed with white pubescence..... niger.
- Body above with pubsecence forming a conspicuous design.
  - Legs entirely black, pubescence of elytra sparse, antennæ pale rufo-testaceous..... subhirtus.
  - Legs rufo-testaceous, hind femora piceous, antennæ pale rufo-testaceous, pubescence of elytral design dense and nearly white..... ephippiatus.

O. pallicornis Say. Curc. N. A., p. 16; Am. Ent. edit. Lec. Vol. I. p. 280.

Oblong oval, black, moderately shining, sparsely clothed with short grayish hairs. Rostrum nearly as long as the head and thorax, subcylindrical, coarsely but sparsely punctured near the tip. Head opaque, finely granulate, and sparsely punctured. Antennæ pale piceo-rufous, club darker, inserted behind the middle of rostrum, funicle six-jointed, first three joints moderately elongate, last three moniliform. Thorax broader than long, sides moderately arcuate, apex narrower, base slightly narrowed, surface sub-opaque, coarsely and rugosely punctured, feebly longitudinally impressed at base. Scutellum black. Elytra oblong oval, at base more than a half broader than the thorax, surface moderately shining, striæ feebly impressed (the sutural and second more distinctly) and with moderately coarse punctures, intervals nearly flat, sparsely punctate. Body beneath black, shining, abdomen moderately coarsely

(the terminal especially) punctured. Legs black, tarsi pale rufo-testaceous. Length .10–.12 inch ; 2.5-3 mm.

This species may be readily known by the six-jointed funicle of the antennæ and by the pubescence of the surface sparsely placed, very inconspicuous even with the lens, and without any tendency to form a design. The antennæ vary somewhat in color, but are never black. The tarsi are always pale rufo-testaceous.

Three specimens before me are from Illinois, and another from near Puget Sound.

O. niger n. sp.

Black, sub-opaque, surface clothed with nearly black, recumbent pubescence, elytra with faint pruinose transverse band at one third from base. Rostrum cylindrical, as long as head and thorax, moderately punctured over its entire surface. Antennæ piceous, inserted near the middle of the rostrum. Thorax broader than long, narrower in front, sides moderately arcuate, base slightly narrowed, surface coarsely, deeply, and moderately densely punctured, sparsely clothed with brownish pubescence, with a few cinereous hairs along the middle and sides. Scutellum densely clothed with silvery-white hairs. Elytra moderately robust, slightly longer than wide, one-half wider at base than the thorax; surface moderately deeply striate, striæ coarsely punctured, intervals flat, rugulose, clothed with short, recumbent, brownish pubescence, and an irregular transverse pruinose band near the basal third. Body beneath and legs black, shining, abdomen moderately coarsely punctured. Length .08–.10 inch ; 2–2.5 mm.

The conspicuously white scutellum is a notable feature in this species. Occurs in Nova Scotia, Canada, and Illinois.

O. subhirtus, n. sp.

Black, feebly shining, surface moderately clothed with brownish hair, and with grayish hair forming an irregular band near the basal third, broadest at suture, and a narrower band near the apex of irregular form and much narrower than the preceding. Rostrum cylindrical, moderately arcuate, coarsely punctured. Antennæ testaceous, inserted near the middle of the rostrum. Thorax nearly three-fourths wider than long, sides moderately arcuate, apex narrower than base, surface opaque, sparsely rugosely punctured, and very sparsely cinereo-pubescent. Scutellum cinereo-pubescent. Elytra oval, longer than wide, at base one-third broader than the thorax, striate, striæ coarsely punctured, intervals flat, rugulose, surface sparsely clothed with dark brownish pubescence, and with an irregular sub-basal band of cinereous pubescence broadest at the suture, anterior and posterior margins sinuous, and a sub-apical narrower band. Body beneath black, sparsely pubescent, moderately punctured and shining. Legs piceous-black, tarsi pale testaceous. Length .08 inch ; 2 mm.

The pubescence clothing the surface is coarser than in the other species

in our fauna, and the design formed by the cinereous pubescence is very distinct, much more evident than in *niger*, but much less so than in *ephippiatus*.

Two specimens are before me from Illinois.

O. ephippiatus Say. Curc. N. A., p. 16; Am. Ent. edit. Lec. Vol. I. p. 289.

Piceous, moderately robust. Rostrum rufous, cylindrical, moderately punctured. Antennæ pale rufo-testaceous. Head rugosely punctate, sub-opaque. Thorax broader than long, apex narrower, sides moderately arcuate, median line slightly impressed, surface rugosely punctured and very sparsely cinereo-pubescent. Scutellum white. Elytra moderately robust, slightly longer than wide, at base one-third wider than the thorax, striate, striæ moderately coarsely punctured, intervals flat, rugulose, clothed with dark brown pubescence and with a large irregular space near the base, and a sub-apical irregular band densely clothed with silvery-white hairs. Body beneath black, shining, sparsely punctured. Legs pale rufous, hind femora piceous. Length .12 inch; 3 mm.

The surface color of the elytra is not entirely piceous, that covered by the white hairs being rufous. The conspicuous character of the design will make this species readily known.

Two specimens are before me, one from Pennsylvania, the other Illinois.

O. puberulus Boh. Eug. Resa, 1859, p. 133. California.

Unknown to me.

The species of *Orchestes*, as far as known to me in our fauna, have the femora unarmed. The larva undergoes its changes in a cocoon, which it prepares in a manner still unknown to science. The same habit has also been noticed by Mr. C. V. Riley in *Prionomerus calceatus* (Say), (carbonarius *Gyll.*), and *Phytonomus comptus* Say, of which full accounts will doubtless soon appear.

Rhyssomatus Schönh.

Our species are few in number, and are thus distinguished:

Body above black, sometimes with obsolete brownish elytral spots.

Alternate elytral intervals more elevated; a short humeral carina.

Thorax very obliquely strigose, elytra obsoletely maculate ..... palmacollis.

Thorax longitudinally strigose, elytra entirely black.... lineaticollis.

Elytral intervals equal, humeral carina attaining the apex.

Thorax feebly obliquely strigose ..... æqualis.

Body above brown, surface sparsely pubescent; humeral carina entire.

Thorax obliquely strigose ..... pubescens

R. palmacollis Say. Curc. N. A., pp. 16, 27; Am. Ent. edit. Lec., I., pp. 279, 295; Boh. Schönh. Gen. Curc. IV., p. 366.

Form short, robust, oval, black, feebly shining. Rostrum as long as thorax, moderately arcuate, sparsely punctured at tip, at sides feebly sulcato-punctate, above carinate at base. Head densely punctured. Thorax nearly twice as wide at base as long, sides gradually arcuate, apex moderately constricted, base feebly arcuate, disc moderately convex, median line finely carinate, and with deep strigæ, oblique and parallel, surface glabrous. Scutellum densely clothed with brownish pubescence. Elytra oval, gradually and arcuately narrowed to apex, very convex, with rows of deep oblong punctures, suture and each alternate interval acutely carinate and a short carina at humerus, color black obsoletely spotted with brownish especially near the apex, the spots slightly pubescent. Body beneath coarsely, abdomen and legs more finely and densely pubescent, each puncture bearing a very short yellowish hair at bottom. Femora moderately toothed, tibiæ with a tooth near the apex externally. Length .24 inch; 6 mm.

The oblique strigosites of the thorax are nearly at right angles to the sides of the thorax, and the basal line of the thorax is straight and transverse opposite the scutellum.

Occurs in Florida and Texas, not common.

R. lineaticollis Say. Journ. Acad. III., 1823, p. 313; Curc. N. A. and Am. Ent. ut supra; Boh. Schönh. Gen. Curc. VIII., 2, p. 9.

Similar in form and sculpture to the preceding, differing as follows:

Rostrum acutely carinate at basal half, a slight impression slightly above the eyes. Thorax more than twice as wide as long, sides strongly arcuate, apex scarcely constricted, surface with deep strigæ, longitudinal and parallel with the median line, becoming slightly arcuate near the sides. Scutellum glabrous or very nearly so. Elytra entirely black without brownish pubescent spots. Length .22–.26 inch; 5.5–6.5 mm.

The basal line of thorax at middle is slightly arcuate and approaches more nearly the scutellum.

Occurs from Pennsylvania to Kansas and Texas.

R. æqualis n. sp.

Robust, oval, black, feebly shining. Rostrum sparsely punctured in front, basal half punctato-sulcate, not carinate. Head moderately densely punctured. Thorax one-third wider at base than long, sides arcuate, apex feebly constricted at the sides, base feebly arcuate, surface obliquely arcuately strigose, with a few punctures along the apical and basal margins. Scutellum not pubescent. Elytra oval, feebly narrower at apex, surface with rows of coarse deep, elongate punctures, intervals nearly flat, slightly reticulately rugulose, no short humeral carina. Body beneath coarsely, abdomen very densely and more finely punctured. Length .16 inch; 4 mm.

The intervals are not absolutely equal, some are flat the others slightly

convex but the difference is not sufficient to be noticed readily, and the intervals being thus equal the short carina at the humerus disappears.

Pennsylvania, Illionis, Kansas.

R. pubescens, n. sp.

Oval, moderately robust, brownish ferruginous, feebly shining, sparsely clothed with yellowish hairs over the entire surface. Rostrum rather slender, sparsely punctured, at sides punctato-sulcate, above not carinate. Head coarsely and very densely punctured. Thorax nearly twice as wide at base as long, sides arcuate, apex moderately constricted, base feebly arcuate, surface moderately convex, median line not carinate, with oblique strigæ closely placed and a few punctures along the apical and basal margins. Scutellum sparsely pubescent. Elytra feebly narrower to the tip, surface with rows of coarse, deep, nearly round punctures not closely placed, intervals alternately carinate, the flat intervals densely punctulate. Body beneath colored as above, coarsely punctured, abdomen more finely and densely, sparsely pubescent. Legs concolorous. Length .22 inch; 5.5 mm.

This species agrees with the first two in having the intervals alternately cariniform and a short humeral carina, but differs from all our species in the color and the pubescent surface.

Two specimens, Owen's Valley, California.

CHALCODERMUS Schönh.

This genus is so closely allied to *Rhyssomatus* that it becomes a matter of difficulty to separate them when the foreign species are considered. Lacordaire relies on the character afforded by the hind tibia in which the tip or truncature is entirely open in *Rhyssomatus* and closed by a ridge in the present genus.* Our species are few in number and are the more readily known by their more slender rostrum and the absence of any tooth near the apex of the tibiæ on the outer edge.

Our species are as follows:

Elytra striate, intervals elevated.
- Surface ferruginous (with aeneous tinge)..... pruinosus.

Elytra not striate but with rows of coarse punctures.
- Thorax suddenly narrowed in front, coarsely punctured..... aeneus.
- Thorax deeply longitudinally strigose; body brown elytra paler..... collaris,
- Thorax irregularly strigose; body black..... inaequicollis.

* For a fuller account of this character see Genera des Coléoptères, Vol. 6, p. 11. The truncatures of the hind tibiæ Lacordaire designates as "*corbeilles*," a technical word having no equivalent in our language, and the difference meant by "*corbeilles caverneuses*" and "*découvertes*" are there fully exposed.

C. pruinosus Boh. Schönh. Gen. Curc. VIII, 2, p. 13.

Oval, convex, ferruginous, moderately shining. Rostrum sparsely punctured in front, at base feebly longitudinally sulcate, above carinate. Head sparsely punctured, eyes moderately separated. Thorax nearly twice as wide at base as long, sides gradually, arcuately wider to base, apex very feebly constricted, base feebly sub-bisinuate, surface moderately convex, median line slightly smoother, coarsely and moderately densely punctured, the punctures tending to strigosity at the sides. Scutellum small, round, glabrous. Elytra oval, arcuately and but feebly narrowed toward apex, surface deeply striate, striæ with coarse punctures, intervals subacutely convex. Body beneath ferruginous, sparsely punctured, abdomen very much smoother. Legs ferruginous, femora dentate, anterior tibiæ with margin sinuous. Length .18–.20 inch ; 4.5–5 mm.

Boheman describes this species as having a slight aeneous tinge to the surface, a character not possessed by any of the three specimens before me. One of the specimens has the intervals of the elytra quite conspicuously punctulate but does not otherwise differ.

Occurs in Arizona and Peninsula of California.

C. æneus Boh. Schönh. Gen. Curc. IV, p. 388.

Black with faint bronze tinge. Rostrum sparsely punctulate, feebly carinate. Head sparsely punctulate, eyes very narrowly separated. Thorax one-fourth wider at base than long, anteriorly rather suddenly narrowed, behind the constriction obtusely subangulate, thence feebly arcuate and scarcely broader to base, the latter decidedly bisinuate, surface convex, sparsely perforato-punctate. Scutellum small, glabrous. Elytra oval, subparallel in front, toward apex arcuately narrowed, convex, with rows of deeply impressed punctures, intervals extremely minutely alutaceous and with a row of fine punctures each bearing a very minute scale. Body beneath black, coarsely punctured, abdomen more sparsely punctured, terminal segment more densely punctured. Legs black, coarsely punctured, femora dentate, anterior tibiæ narrower at basal third. Length .20-.22 inch ; 5–5.5 mm.

Occurs in Georgia and Florida. Easily known by the coarsely perforato-punctate thorax.

C. inaequicollis n. sp.

Black with distinct aeneous tinge. Rostrum sparsely punctured at tip, feebly sulcate at sides near base, above obtusely subcarinate. Head sparsely punctured, eyes moderately distant with an impressed puncture between them. Thorax one-fourth wider at base than long, sides in front feebly sinuous and thence feebly arcuate to base, surface shining, median line carinate in front, suddenly wider at middle, on each side a

deep sulcus, anteriorly and laterally with deep broad irregular sulci, on each side of median sulci a smooth space. Other characters as in the preceding species. Length .22 inch ; 5.5 mm.

The sides of the thorax beneath are sculptured with deep broad, short grooves, while the preceding species has deep foveate punctures.

One specimen, Georgia.

C. collaris n. sp.

Brownish with aeneous lustre. Rostrum sparsely punctured, sides at base feebly sulcate. Head sparsely punctured, eyes moderately separated, a slight impression between them. Thorax one-third wider at base than long, sides slightly sinuate in front, thence arcuate to base, surface deeply longitudinally strigose, anteriorly slightly punctured. Scutellum small, smooth, aeneous. Elytra ferruginous with aeneous lustre, obsoletely maculate with brownish, sculptured as in the preceding species. Body beneath and legs as in the preceding species. Length .22 inch ; 5.5 mm.

One specimen, Texas, differs in color and thoracic sculpture from any of our species.

ANALCIS Schönh.

In all the species which I have examined, I have been unable to detect any variation in the number of the dorsal abdominal segments between the specimens which I have superficially considered as opposite sexes.

The species divide themselves naturally into two distinct forms, the one opaque and more or less clothed with scales forming bands of variable width, the other shining,æneous, and without any surface vesture The following table shows their further relationship.

Body above black, varying to rufous, surface usually opaque with scale-like vestiture, abdomen punctured.	
Thorax coarsely foveolato-punctate, surface irregular.	
Elytra at base with large pentagonal punctures, at apex the striæ and punctures obsolete	morbillosus.
Elytra at base with large round punctures arranged in very regular rows, striæ and punctures at apex distinct	foveolatus.
Thorax with coarse punctures evenly distributed	variegatus.
Thorax very densely punctured	fragariæ.
Body above æneous, shining, without vestiture, thorax indistinctly punctured, abdomen smooth	æreus.

A. morbillosus Lec. Pacif. R. R. Rep. App. 1, p. 58.

Oblong, black, opaque. Rostrum coarsely and densely punctured, at base a slight fovea, surface with distant white scales more dense in the

fovea. Thorax longer than wide, moderately convex, sides obliquely narrowed in front, very feebly arcuate to base, the latter slightly lobed, surface moderately convex, with very coarse punctures on each side of middle (which has a smooth space) at the sides less coarse, and with white scales in the punctures. Elytra broader than the thorax, parallel, at apex rounded, convex, surface with rows of very coarse pentagonal punctures becoming rapidly smaller towards the apex where the striæ are rather more evident and the punctures extremely small; vestiture consisting of white elongated scales in the larger punctures and patches arranged as follows:—a small spot on each side of the scutellum, an oblique narrow band from the humerus towards the suture more or less interrupted, a transverse band at two-thirds interrupted at the suture with its anterior and posterior edges of very irregular outline. Body beneath black, opaque, very coarsely punctured. Legs black moderately punctured, each puncture with a short white scale. Length .20 inch; 5 mm.

One specimen, San Francisco.

A. foveolatus Say, Curc. N. A. p. 19; Am. Ent. ed. Lec. I, p. 284; Germ. (*Cryptorhynchus*), Schönh. Gen. Curc. IV, p. 140.

Closely allied to the preceding species and differing as follows: Thorax obliquely narrowed in front and slightly sinuous, sides thence moderately arcuate and at base slightly convergent, surface with large foveæ closely placed on each side of median line so that the latter appears carinate, foveæ at sides smaller, fovea with yellowish white scales and a denser line of scales within the margin approaching the middle in front. Elytra with rows of large, round, deep punctures arranged in regular striæ becoming gradually smaller to apex; vestiture as in the preceding species but consisting of yellowish scales. Length .16–.20 inch; 4–5 mm.

The lateral striæ of the elytra have coarse punctures in their entire length while the preceding species has four or five punctures at base only. It is possible that further specimens will unite the two species.

Occurs from Pennsylvania to Iowa and Georgia.

A. variegatus n. sp.

Oblong, moderately shining, piceous, varying to rufous. Rostrum shining, coarsely and irregularly punctured, at base not foveate. Thorax of nearly oblong oval form, longer than wide, subtruncate at base which is narrower than the thorax at middle, surface moderately convex, with coarse punctures finer at the sides, rather unevenly disposed, vestiture arranged as in the preceding species. Elytra oblong oval, sides moderately arcuate, disc with rows of coarse punctures becoming rapidly finer towards the apex where the striæ become more evident; vestiture arranged as in the preceding species but scarcely scalelike, the surface covered by the pubescence rufous, the naked parts black or piceous. Body beneath black, shining, coarsely and sparsely punctured. Length .14–.18 inch; 3.5–4.5 mm.

The elytra are never in this species as in the preceding, totally black, there being in all the specimens an oblique humeral stripe and the subapical band rufous, these rufous spaces may extend themselves so that the black almost entirely disappears excepting in a small triangular lateral space and the extreme tip. The vestiture is hairy rather than scale-like.

Occurs from Illinois to and throughout the Gulf States.

A. fragariæ Riley. Third Annual Report on the Noxious, Beneficial, and other Insects of the State of Missouri. 1871, p. 42, fig. 14.

Form oblong, rufo-piceous, elytra paler. Rostrum moderately coarsely and densely punctured and with a triangular fovea at base. Thorax as in the preceding species, densely and moderately coarsely punctured, each puncture with a short slender scale. Elytra oblong oval, sides arcuate. wider behind the middle, with rows of moderately coarse punctures which become gradually smaller towards the apex without the striæ becoming more evident; pale rufous very sparsely clothed with short cinerous scale-like pubescence, arranged more densely in two crescentic bands on each elytron, placed slightly obliquely, and behind each band a small fuscous spot. Body beneath rufo-piceous, coarsely punctured, legs paler. Length .16 inch; 4 mm.

A specimen of this species was sent me by the late B. D. Walsh, bearing the name which Mr. Riley had adopted. It differs from every species known by the dense and even punctuation of the thorax. Injures the Strawberry plant.

Occurs in Illinois and Missouri.

A. æreus Say. Curc. N. A. p. 29; Am. Ent. edit. Lec. I, p. 297; Rosensch. Schönh. Gen. Curc. IV, p. 279.

Black, shining, upper surface with distinct æneous lustre. Rostrum densely and moderately coarsely punctured, at base a fine sulcus, thorax longer than wide, apex rounded, base feebly bisinuate, sides in front obliquely and slightly sinuously narrowed, at basal half nearly straight and parallel; surface convex, punctuation variable but never more than sparsely punctulate. Elytra with rows of moderate punctures at base, apex smooth. Body beneath black, shining coarsely and sparsely punctured, abdomen smooth. Legs black, moderately punctured. Length .12–.16 inch; 3–4. mm.

The punctuation of the thorax varies. In the typical form the disc is smooth and the sides only sparsely punctured. In the larger specimens the disc is distinctly punctured but the punctures are always moderate and very sparsely placed. The specimens from the Gulf States are smaller. The largest before me are from Iowa.

Occurs from Pennsylvania to Iowa and Louisiana.

RECENT CONFIRMATION OF AN ASTRONOMICAL PREDICTION.

By Pliny Earle Chase,
Professor of Physics in Haverford College.

(*Read before the American Philosophical Society, October* 3, 1873.)

In a communication to the Society on the 2d of May last, I gave certain harmonic indications of "a possible unknown planet, planetoid group, or other seat of solar and planetary perturbation" at about $\frac{7}{25}$ of the Earth's mean distance from the Sun.* I also suggested that Wolf's supposed sun-spot period of twenty-seven days "might be readily explained by the perturbations and transits of a planetoid or meteoric group, at a distance which would complete the terrestrial harmonic series." If there is any such source of perturbation, there should be not only maxima and minima of sun-spots at average intervals corresponding with the period of solar rotation, but there should also be subordinate maxima and minima at intervals of a half-rotation, inasmuch as the tidal influence would be exerted simultaneously at opposite extremities of the same solar diameter.

During my summer holidays I was enabled, through the courtesy of Prof. Joseph Winlock, Director of the Observatory of Harvard University, to examine observations of sun-spotted area, extending over a period of nearly five months. They furnished indications of such disturbances as I have described, but the period of observation was so short that I did not regard them as conclusive.

On my return to Philadelphia, I found in *Nature*, of July 17, an abstract of a communication to the Royal Society on June 19, by Messrs. De La Rue, Stewart and Loewy. Those eminent observers adduce evidences of a tendency in sun-spots "to change alternately from the north or positive to the south or negative hemisphere, and *vice versâ*," and they attach special significance to the fact "that *the two outbreaks are at opposite ends of the same solar diameter.*" These conclusions are based upon three sets of observations, taken in three different years, and extending over periods, respectively, of 145, 123, and 139 days. Their lowest approximate estimate of the mean interval between two maxima *of the same sign*, is 22.25 days; the highest, 28 days; "the most probable mean value, 25.2 days." The interval between two maxima of the same sign *and originating at the same axial extremity*, would of course be twice as great.

There seems, therefore, to be conclusive evidence of some disturbing force, revolving around the Sun in a period approximately equivalent to two solar rotations. The mean radius vector of such a disturbing force should be:

According to Spörer	.263
" Carrington	.265
" Faye	.266

*Ante p. 238; see also *New York Tribune*, May 2, 1873.

According to Wolf..... .267
" De La Rue, Stewart and Loewy..... .267
" Herschel (Bianchi and Laugier)..... .268
" Harmonic analogy, a* ..... .267
" " " β..... .269

COMPARISON OF PLANETARY SERIES.

The closeness of the foregoing accordance may lend interest to a comparison of my own planeto-tactic series with those which have preceded it.

Jupiter, being about two and a-half times as great as the aggregate mass of all the other planets, may be regarded as forming with the Sun a binary star. The mutual action of the two controlling orbs of the system, is greatest at perihelion. A mean radius vector corresponding to the Schwabe sun-spot cycle, would be $(11.07)^{\frac{2}{3}} = 4.967$, which corresponds very closely with Jupiter's secular mean perihelion distance (4.9787, according to Stockwell, which would give a cycle of 11.11 years).

If the mean perihelion centre of gravity of the binary Star, Sun and Jupiter, be regarded as the extremity of a linear pendulum, of which the Sun's centre is the point of suspension, let us designate the distance of the centre of oscillation of the pendulum from the point of supension by a.

$\pi \times a$ = major axis of solar orbit about *c. g.* of binary star..... $= \beta$
$\pi^3 \times \beta$ = Mercury's mean perihelion distance..... $= \gamma$
$\pi \times \gamma$ = Earth's " " ..... $= \delta$
$\pi \times \delta$ = Asteroid at distance $= 2 \times$ Mars..... $= \varepsilon$
$\pi \times \varepsilon$ = Saturn's mean distance..... $= \zeta$
$\pi \times \zeta$ = Neptune's " ..... $= \eta$
$\frac{2}{3}\eta$ = Uranus's mean aphelion distance..... $= \theta$
$\frac{2}{5}\eta$ = Saturn's " " ..... $= \iota$
$\frac{2}{8}\eta$ = ?
$\frac{2}{11}\eta$ = Jupiter's mean perihelion distance..... $= \varkappa$
$\frac{1}{3}\varkappa$ = Mars's mean aphelion distance..... $= \lambda$
$\frac{1}{5}\varkappa$ = Earth's mean distance..... $= \mu$
$\frac{1}{7}\varkappa$ = Venus's " ..... $= \nu$
$\frac{1}{9}\varkappa$ = Mean of Mercury's and Venus's mean distances..... $= o$
$\frac{1}{11}\varkappa$ = Mercury's mean aphelion distance..... $= \pi$
$\frac{1}{13}\varkappa$ = " " distance..... $= \rho$
$\frac{1}{15}\varkappa$ = " " perihelion distance..... $= \varsigma$

It will be readily seen that all the terms of the foregoing centripetal

*a, assuming Jupiter's radial centre of oscillation as the fundamental unit; β, assuming Earth's mean distance as the unit.

series are in harmonic progression, and that the controlling influence of Jupiter over the progression is strikingly marked. A closer examination shows that the harmonic series which begins with Neptune's linear centre of oscillation is interrupted by the great masses of Jupiter and Saturn, and that the one which begins at Jupiter's mean perihelion is disturbed by the masses of Earth and Venus. The value of ν is very nearly an arithmetical mean between Venus's mean distance and her mean perihelion distance. The radius of Jupiter's mean linear centre of oscillation ($\frac{4}{5}$ of 5.2028 = 3.4685) is nearly equivalent to $\frac{7}{2}$ of Earth's mean radius vector, or to a radius vector (3.513) at the extremity of which, if the planetary masses were aggregated, the centre of gravity of the solar system would be at the source of the Sun's radiant undulation. From these three units we may derive the following harmonic series :

$\frac{1}{1}$	= 3.468	$\frac{1}{1}$	= 3.500	$\frac{1}{1}$	= 3.513		
$\frac{1}{5}$	= .694	$\frac{1}{5}$	= .700	$\frac{1}{5}$	= .703	Venus's mean perihelion	= .698
$\frac{1}{9}$	= .385	$\frac{1}{9}$	= .389	$\frac{1}{9}$	= .390	Mercury's mean distance	= .387
$\frac{1}{13}$	= .267	$\frac{1}{13}$	= .269	$\frac{1}{13}$	= .270	Radius of solar disturbance	= .267
$\frac{1}{17}$	= .204	$\frac{1}{17}$	= .206	$\frac{1}{17}$	= .207	Vulcan ?	= .209

The value above given for Vulcan is the one which satisfies Kirkwood's estimated period for that supposed planet. If the actual values of Venus's mean perihelion and Mercury's mean distance be taken for two of the harmonic terms, and Jupiter's mean distance for the fundamental unit, we shall have the following harmonic series :

1 ÷ 7.1343 = Venus's mean perihelion distance.
1 ÷ 12.8604 = Mercury's " distance.
1 ÷ 18.5865 = .2678 × Earth's mean distance.
1 ÷ 24.3126 = .2048 × " "

There is, therefore, an apparent break in the harmonic progression, at a distance between .267 and .270 of the Earth's mean distance from the Sun, and within those limits we may reasonably look for the source of the peculiar sun-spot disturbances, which were pointed out by Messrs. De La Rue, Stewart and Loewy, in the communication above referred to.

The closeness of the approximations in my circular and harmonic series is shown in the following table. I take as the basis of my calculations, Bessel's valuation of Jupiter's mass (1 ÷ 1047.879), and Stockwell's estimate of Jupiter's mean eccentricity (.0431601). Sun's radius is taken as the unit. The error of the theoretical value is found by dividing the difference between the theoretical (T) and observed (O) values by the observed value.

CIRCULAR CENTRIFUGAL AND HARMONIC CENTRIPETAL SERIES.

	T.	O.	Error.
α	.680	.680	
β	2.136	2.132	+ .0020
γ	66.224	68.483	— .0330

	T.	O.	Error.
δ	208.048	207.583	+ .0022
ε	653.600	654.760	— .0018
ζ	2053.346	2049.514	+ .0019
η	6450.776	6453.731	— .0005
θ	4300.517	4306.485	— .0014
ι	2150.258	2148.609	+ .0008
$\varkappa$	1075.129	1069.623	+ .0052
λ	358.376	353.263	+ .0145
μ	215.026	214.860	+ .0008
ν	153.590	155.415	— .0118
o	119.459	119.293	+ .0014
π	97.739	97.861	— .0012
ρ	82.702	83.172	— .0057
ς	71.675	68.483	+ .0466
Sum	18059.281	18053.947	+ .0003

The assumed "failure" of Bode's series, in the case of Neptune, disappears if we make the series symmetrical, as I have already suggested, by introducing two equal differences at the outer, as well as at the inner limit of the planetary belt. In the following table, Earth's mean distance is taken as the unit.

BODE'S SERIES, MODIFIED.

	T.	O.	Error.
☿ m*	.4	.387	+ .0333
♀ p	.7	.698	+ .0029
⊕ m	1.0	1.000	.0000
♂ a	1.6	1,644	— .0269
☿ m	5.2	5.203	— .0005
♄ a	10.0	10.000	.0000
♅ m	19.6	19.183	+ .0217
Ψ p	29.2	29.735	— .0180
Sum	67.7	67.850	— .0022

The following table exhibits Peirce's phyllotactic series of sidereal periods† in the form in which the original investigation was made by Dr. Thomas Hill, in 1849, at Professor Peirce's request. For convenience of comparison with other series, I give not only the error (α) of time, but also the corresponding errors (β) of mean distance, (γ) of mean or perihelion distance.

* m, mean; a, mean aphelion; p, mean perihelion.

† Proc. Amer. Assoc., v, 2, Cambridge meeting.

PEIRCE'S PHYLLOTACTIC PLANETARY SERIES.

	T.	O.	Error α	Error β	Error γ
♆		[60127]			
♃ $\frac{1}{2}$ ♆	30063	30687	— .0203	— .0136	m — .0136
♄ $\frac{1}{3}$ ♃	10229	10759	— .0493	— .0331	p + .0152
♅ $\frac{2}{5}$ ♄	4304	4333	— .0067	— .0045	m — .0045
Ast. $\frac{3}{8}$ ♅					
♂ $\frac{5}{13}$ Ast.	625	687	— .0902	— .0611	p + .0180
⊕ $\frac{1}{2}$ ♂	343	365.26	— .0609	— .0410	p — .0071
♀ $\frac{8}{13}$ ⊕	224.7	224.7	.0000	.0000	m .0000
☿ $\frac{2}{3}$ ♀	89.88	87.97	+ .0217	+ .0144	m + .0144
Sum	45878.58	47143.93	— .0269	— .0180	— .0033

Chauncey Wright, in the Mathematical Monthly, vol. 1, p. 244, referred the phyllotactic law to nodes of extreme and mean ratio, which he called "the *distributive ratio*." The same law which distributes leaves most evenly around the stem, would distribute planetary perturbations most evenly around the Sun.

Kirkwood (Proc. Amer. Phil. Soc., v. 12, p. 163) gave a harmonic series which differed from Peirce's phyllotactic series by the omission of the asteroidal term, and by the substitution of $\frac{1}{6}$ ♅, $\frac{1}{12}$ ♅, and $\frac{2}{3}$ ⊕, for $\frac{5}{13}$ Ast., $\frac{1}{2}$ ♂, and $\frac{8}{13}$ ⊕, in the expressions for the periodic times of Mars, Earth, and Venus, respectively. His approximations were closer than Peirce's for Mars and Earth, but not so close for Venus. The omission of any terms which depend directly upon the asteroidal belt and upon Mars, renders his series less symmetrical than Peirce's.

In the following table, the errors of the closest planetary approximations in each series are given for the purpose of comparison:

ERRORS OF THEORETICAL PLANETARY POSITIONS.

	Bode.	Peirce.	Kirkwood.	Chase.
☿	+ .0333	+ .0144	+ .0144	— .0057
♀	+ .0029	.0000	+ .0001	— .0118
⊕	.0000	— .0071	— .0079	+ .0008
♂	— .0269	+ .0180	+ .0337	+ .0145
♅	— .0005	— .0045	— .0045	+ .0052
♄	.0000	+ .0152	+ .0152	+ .0008
♃	+ .0217	— .0136	— .0136	— .0014
♆	— .0180	.0000	.0000	— .0005
Sum	— .0022	— .0018	— .0015	+ .0001

All of these approximations are so close as to preclude the idea of merely accidental coincidence, and to encourage an attempt to find some causal nexus through which they may all be referred to the law of gravitation.

Peirce's series has the special merit of being the first for which any reason was given. It represents the *mean* planetary distances more nearly than either of the other series, and if we accept the nebular

hypothesis, we may perhaps regard it as indicative of the initial tendency to planetary aggregation, inasmuch as we may reasonably suppose that the phyllotactic, or "distributive," ratio was most operative when the nebulous diffusion was greatest.

Bode's series, like Kepler's laws, seems to have been at first merely empirical. But if we conceive a rotating nebulous mass, with a slight equatorial nucleus of condensation, the line of particles between the nucleus and the centre will be influenced by tendencies to two different kinds of motion: first, as portions of a rotating mass, with velocities varying as the distance; second, as revolving particles, with velocities varying inversely as the square root of the distance. The first of these tendencies, combined with the moment of inertia, would urge such particles as were free to move, towards the linear centre of oscillation. If Mercury's mean distance be taken as the point of suspension, Uranus is situated approximately at Neptune's linear centre of oscillation, and each of the planets between Uranus and Venus, is at the linear centre of oscillation between the next superior and the next inferior planet.

My own series is based on the hypothesis that undulations excited in the elastic æther, like those of air, strings, and other elastic bodies, tend to produce harmonic as well as equivalent undulations. The orbital motions of planets, may be regarded as tangential undulations which have been deflected into circles by the continual influence of gravity, and the equivalent radial undulations seem to have determined the π series of groupings in planetary pairs, while the harmonic undulations have been most operative within the planetary belt, where the planetary and æthereal vibrations are in constant mutual inter-action. It will be seen that the mean error of Bode's eight terms (.0022), is more than seven times as great as that of my sixteen terms (.0003), and nearly twenty-seven times as great as that of the eight terms in my series which are directly comparable to his (.0000822). I can think of no mode of gravitating action which will account for such close accordance, as well as for the modifications of the harmonic series by planetary mass and the confirmation of my harmonic prediction, except the one I have already mentioned, the influence of equivalent and harmonic vibrations in an indefinitely elastic æther.

All of the terms in each series, except the Bodeian term for Neptune, *represent actual planetary positions*, or positions within the secular variations of planetary eccentricity. Stockwell's discussion of the secular variations of the orbital elements of the eight principal planets, has shown that the most important of the correlated apsides are the same as are represented in my harmonic series, for he has pointed out the following curious relations:

"I. The mean motion of Jupiter's perihelion is exactly equal to the mean motion of the perihelion of Uranus, and the mean longitudes of those perihelia differ by exactly 180°. II. The mean motion of Jupiter's node on the invariable plane is exactly equal to that of Saturn, and the mean longitudes of these nodes differ by exactly 180°."

Jupiter's perihelion is therefore properly comparable with the aphelion of Uranus. A like comparability with Saturn's aphelion is not immediately evident, but "the orbit of Saturn is affected only by the *difference* of the perturbations by Jupiter and Uranus;" Saturn and Jupiter always act on the inclination of the orbit of Uranus in opposite directions; "the eccentricity of the orbit of Saturn always increases, while that of Jupiter diminishes, and *vice versâ*;" therefore while either apsis of one of the planets is approaching the Sun, the corresponding apsis of the other planet is receding and the opposite apsis approaching. Then, if we look only to secular mean positions, Jupiter and Uranus are simultaneously in opposite apsides; and opposite apsides of Jupiter and Saturn are simultaneously approaching to, or receding from, the Sun.

The fundamental centre of oscillation which forms the unit of the π series, is determined by Jupiter's mean perihelion, with which, as we have just seen, the mean aphelia of Saturn and Uranus are correlated, and the same harmonic relations which subsist between these three important planets, fix, with close approximation, cardinal positions of the other planets.

If planetary positions and times have been determined by mutual gravitating action, it seems probable that in planetary masses and in the normal undulations of the æther itself, simple relations to the same action may be traceable. Stockwell says (p. xvii), "a comparison of the values * * * has suggested the inquiry whether there may not be some unknown physical relation between the masses and mean distances of the different planets." I believe that Proctor, and probably other astronomers, have also suggested such a relation, but I am not aware that one was ever pointed out until I called the attention of the Society (Proc. Amer. Phil. Soc., xiii, 141) to the equality between the mean moments of inertia of the two principal planets (Jupiter, $5.2028^2 \times 9543 = 258318$; Saturn, $9.5389^2 \times 2856 = 259851$).

Of the many correlations of light and gravity which I have hitherto indicated, the two following seem especially interesting in this connection. 1. The synchronism between the passage of a luminous undulation from the Sun to the centre of oscillation of the outermost planet, and the rotation of the Sun on its axis; 2. The equality of the limiting velocity of rotation to the velocity of light. In my original announcement of this equality, I introduced, as one of the elements of my calculation, the Sun's centre of spherical gyration. To this the very reasonable objection has been urged, that we know nothing of the internal density of the Sun. I therefore submit the following considerations, which are entirely independent of solar density.

In particles moving freely about an attracting centre, the mean $(4r \div t)$ velocity of oscillation through the centre of gravity, is to the velocity $(2\pi r \div t)$ of synchronous circular revolution about the centre of gravity, as 2, is to π. The velocity acquired by falling, from an infinite distance, to the extremity of any radius, is $\sqrt{2\,gr}$. If we suppose that the velocities of free oscillation and revolution are each retarded in the same pro-

portion at the surface of the rotating Sun, and designate the mean velocity of retarded oscillation by v_1; the velocity of infinite fall by v_2; under any assumed expansion or contraction of the Sun's mass, $v_1 \propto \frac{1}{r}$,* while $v_2 \propto \sqrt{\frac{1}{r}}$. If we wish to find the limiting velocity v^0 for the value of r, $(r^0 = r \div x^2)$, which renders $v_1^0 = v_2^0$, we have the equation

$$v^0 = v_1^0 = v_2^0 = v_1 x^2 = v_2 x$$
$$\therefore x = v_2 \div v_1$$

Taking Norton's estimate of solar radius (425,061.5) the value of v_2 is 375.5 miles per second, and various estimates of the time of solar rotation give the following values of v_1 and v_0.

	v_1	v_0
Spörer	.799	176,440
Carrington	.788	178,920
Lelambre	.787	179,210
Faye	.785	179,660
Petersen	.781	180,470
De La Rue, Stewart and Loewy	.781	180,560
Herschel, (Bianchi and Laugier)	.777	181,460
Harmonic prediction ($\frac{7}{26}\oplus$)	.771	182,800

The velocity of light, as deduced from Norton's value of solar radius, is 183,450 miles per second, which is approximately identical with the limiting velocity, v_0.

TRANSCRIPT OF A CURIOUS MANUSCRIPT WORK IN CYPHER, SUPPOSED TO BE ASTROLOGICAL.

By Pliny Earle Chase.

(*Read before the American Philosophical Society, October 3d*, 1873.)

The work, of which I have prepared the accompanying transcript, was bought in Amsterdam, about seventy years ago. It consists of forty-four manuscript pages, on twenty-four triangular leaves of parchment, measuring nine inches on a side, substantially bound in a hog-skin cover. It has been kept in a plush-lined tin case, so that it is in a state of excellent preservation, and appears as if newly written. On the lid of the case is a figure of a dragon, together with the following inscription, greatly defaced, but still distinct enough to be perfectly legible.

"Ex Dono Sapientissimi Comitis St Germain Qui Orbem Terrarum Percucurrit."

The cypher consists of twenty-six arbitrary characters. In preparing to transcribe it, I counted the number of times each character was used, substituting *a* for the one that occurred most frequently, *b* for the next in frequency, and so on. The words are often run together, but there are numerous breaks, which I have indicated, some of which appear to mark divisions between words, while others may be arbitrary, or intended as blinds.

* In consequence of the law of equal areas.

1
jbnbrgacbgfeadaoajaa
bni w adaedihoaakbfc
hfnifhn afe asgmeg
afsmd alg ahc an
afe life ad oaa
afbcga lihl
jbkaogca
khf
kdbsif
bgja

2
jid
pgea
qhaeho
igc bjb mb
ramd alakaf
eaeac ad ogdb
kanikajamihd a
ftbgd akbhedc bhx qh
ajcehkiffad bcfahtpihk
aackajbdrahd ehaftadbc
hcbra mihdimad ad kacnad

3
xagjjac tboahdqhafifc mbc
aha padic s cbflifg beif
eac md akalaccahdc vaea
kiffa afnanaeánmcj
vfeajjgraflakhlb
dblead akifeace
aldgenbdaoaj
begif btgf q
ha ehtadbc
hcbramd
edigc
lui
ca
c

4
md
edih
oadja
cluicac
madkhackbf
c jac nadcka
mhgc japihjoad
canafekhrjipa
md kalih odgdkac ngfac
kakgbnbfec kidskbdrafe
kbfc jac agfkajbeadda

5
md lifcadoad jbcbfea s mdiji
frad jb oga vhcqhbhf cgal
jasbhkajbboal jbtdbg
luahdka lgfqhbfea b
fcsjbtidlakalae
bra
ehtadbc eacima
dbegifc mih
d jackahx
mdangac
ipv
aec

6
ei
heac
jacti
gcqhaja
cijagj jb
eaddas jb jhfa
caedihoadifc afl
ifviflegif chd jb
nanajgrfa skbfc jana
namjbf qhbfe bjb edigcg
ananad oag jjaeh mihdd bc jc

7
tbgda afeihebhedaeanmc nbgc
gjtbhkdbmideadchd eig hfa
tgrhdacanpjbpja blajja
qhaeh oigc glg
(in an astrological diagram)
bjmub s inarb

8
eh
mdaf
kdbchf
obca mdi
mdafgnmidea
ka qhajjanbe
gada ehjadanmjg
dbcka tah qhaehaxi
dlgcadbckajbnbfga
dachgobfea
itahld abehdavaeaxidlgca

9
mbd lajhg mbd qhg eiheac luic ac
ife aeatbgeac btgf qhaehaji
grfakaeig eihe mubfeina
pafgc ja i mad oaeadfaj md
jb rjigd aka eif fin c
bgfes mad nbfafe
eig qhg ogc sd
arfac kbfcei
hc jac cg
aljacka
, cega
lja
c

10	11	12
hf	dlasjahdoadehbhrn afeafe ldbge	bn
jao	a qha jahdc affangef wmhccafe	mac
geaqha	afedadeig qhg ogc sdarfac	bobfeea
ehbhd bc	kbfc eihc jac cgaljac k	cimadbe
boal eig da	ac cgaljac eifjaogead	gifc
mifkdb bnaf	amifkdb bnaf	jamaegeidpge
ehpafgdbc afchge	eh oadcadbclae	aliflafedgqha
akajaflafc sqhbeda	aflafc pafgc	ace ja jg ahihehea
jbnmac ka jb nbfgadac	hd jatahs	eg afkdbc mafkbfeeac
hg obfea ikgahaeadfaj ae	ehbjjhn	imad egifc jbhed aidpg
dacihoadbgf pafgc lae aflafc	adbc	eaqhg ace bh kac cihc ace
slac jbnmacbtgf qhajahdti	eac	jb mjbla qillhmadbeifjaogea
	j	

13	14	15
	eifjaogeeachgodb af mid	
ehcadbcoaehlinnabh xvihd	ebfe jb damdacafebeg	d
ckac ladanifgackac cbldg	if kac lbdblea	afk
tglac af afedbfekbfceif	d ac kad aoaj	hbjbm
idpgeaeh bhdbc afebnb	beg if	jbla qhg
gfrbhlua jbtgrhdacea	jidcqha	e ace kaceg
(in astrological diagram)	ehca	fa ehd anaeed
brjb brjb eaedrbnnbeif	db	bc beif jaogeaj
	c	btgrhda boal jb qha

16	17	18
jjaeh aeigc afed a bji	cb	cieugi pafgc-ja
dc eif jaogea bgbfe	ldaac	cidgzgc pafgc-ja
aeaillhmad jbc	fiein	bmubj pafgc-ja
gaffaehpafgdb	bdrdeae	brani pafgc-ja
ceifidpgea	pafgclaeidp	euipbccb
af mditadb	gea pafgc-ja	pafgc-ja
fe lacm	wbfikb pafgc-ja	bdgy
bdij	ngija pafgc-ja	pafg
ac	bjbr pafgc-ja	cja

19	20	21
p	cjac acmdgec bqhgvbg	j
bzi	kiffa ja mihoigdkam	abnbf
db eig	dacgkad bhuxkajbfh	jalgbp
qbg ogcs	ge aflinnaflbf	pbedbfbogi
darfac kbfce	ekh lieaihca	dgpdbj
ihc jaccgaljac	jaoajacij	eajbdi
kaccgaljac eifj	'agj saf	khlieaihc alihl
aogeadamifkdb bnaf	kgcb	ua ja cijagj
afchgeaehgfoi qhadbcja	e	

22	23	24
ajbfb	a	tgbjalubn
jambp	jaha	lu bdcgaj
hcebaj	kajidgea	ehtadbc aflidkhliea
euaddhp	jagb	ihc ajaoajacijag
ciebdali	ajgfb	j jgfoi lbegif
gjgpbmbl	bngrbpgdaj	chgobfea mdi
kh liea	kh liea ja mjhcpbc	ceadfaoad
jamj	kajidpgea	ejbead
hc	makghpbz	da

25	26	27
fih	vbfbajs lbjybc	jac
coihc	jabci s ogbfiaj	bheac
gfoiqhi	sfihc oihcidkiff	fincka
f wbjbenb	ifc mbd lajhgmbd	j aeafajs
sjangdie	qhg eiheacl	mbd lajhgka
jalgbpseajbd	uic acife	wbfikb
uadgpbrs bdfiogi	aeatbge	aj
edbpb s bgie	csmbd	nguijac
bfgaj sjakgnbe	eih	uijba yapieu
	c	

28	29	30
fijgl cbz	gp	gj wbkac ngfack akgb
s fiebnnbdrbeae	jan af	nbfe kid skbdrafe la
qhg acejac agrfa	e skana	hxqhg dalajafeka
ḥdkg ah ajaoa ka	tbgdaliff	cluicac mdalg
oihedamdaca	igeda mbd hfa	ahcac madkha
fead md ack	vhcea gfcmgdbeg	ckbfcjac nadc ka
alaeidp	if cgoihcn afvhr	mdiji
geag	akgrfa mhdaeakanif	fra
fog	bna mbdjb jac jg ahxih	d
c		

31	32	33
nb	wsoqh bkbn blinmdg	vi
ogac	c mbd jafink brjb mdhi	eu mi
bgfasv	jbmdacadobogifka	hdjbkaj
hcqhbhkajb	jieuscb tbngjj	godbflaka
khf cgalja va	a khtahka cik	vblipkajbm
oihckanbfkal	inaskarin	adcalhegifka
actboahdc cbfc qh	niddr mb	ciftdada mbdlah
ava aflihdafgkbfrad f	djafi	xka cigrbk wbfikb
gdgccqha fgmadggj mbd	nka	euaic ih fiebnnbdrb

34	35	36
eaesmbd jac bhedacfinc	an	bhaljbnbgfrbhluajbt
kh eihe mhgccbfe qhgo	mgda	guhdaqhaeadanaeedb
gesd arfaoadgeb	acechd	eifjaogea bjidc cg
pjanafe eajjaace	eihe mihd	eifbnaaceodbg
jboijifeaka	eihcjac cga	nafemhda ajja
lajhg qhg	ljackac cgal	cajaoadb eh
ldabeih	jac eifjaogead	eacafegd
eskif	amifkdb bnaf	bic gf
ej	ehmjbladbc chdebeaea	img
		da

37
eh
mdae
adbchf
aidagjj
abeeafegoa
beihe laqhaj
acaemdgecbadg
afc weihttadife b
gbfe cigakaedbladka
jbkdigeabjbrbhluachdh

38
fajbnakb gdb gfeihc
jaclbd bleadac gfc
mgdac qhaehpa
fgdbc afchg
ea mbd lac
niec c
iga
w

39
p
afg
cmbi
euaic eh
fajac linn
hfgqh adbc bma
dciffa lbdehead
afkdigc gfkgrfakanb

40
pifea kgogfas ehf bhd
igc mbc jac hll
ac qhaeh bcipe
afk acmadad
ehmd afkd
bc b
ji
de

41
jb
tgr
hd aqh
g aeigec
hd ebeaea bo
al jbnananb
gf ehjbegafkdbc
bkahxnb gfcs mdicea

42
dfa afbkid begifehmdi
fifladbc lacebd
bleadac
bhfe nkaj aea
dfaj kh kga
hodbg n
bgeda
ka

43
n
if
idmc n
if bna s
nif acmdgc
bjjay bjjay af
mbgx daegday oi
hc qh hfkaoihcn bl

44
linmbrfaeihuihdc qh
ajac bhedac ciga
fe mdaec boafgd
jidcqha
uajac
dbmm
ajjad
bg

ON THE LANGUAGE OF THE NATCHEZ.

By D. G. Brinton, M. D.

(*Read before the American Philosophical Society, December 5th*, 1873.)

Of all the native tribes inhabiting the Lower Mississippi, by the common consent of the early travelers the Natchez or Nache were the most civilized. They were located ten or twelve miles below the site of the city which now bears their name, and formed a community of five or eight villages, each ruled despotically by a hereditary chief called a Sun, themselves in subjection to a head Chief, the Great Sun, whose power was absolute over both the life and property of his subjects. In this respect they differed entirely from the tribes around them, whose Chiefs were elective and limited in their control.

The Nache furthermore had unusual skill in the arts, weaving a textile fabric of the inner bark of the mulberry tree, with which they clothed themselves, and displayed in the construction of their dwellings and temples, and in their mode of worship, more developed ideas than their neighbors. They were accustomed to build artificial mounds, to sacrifice slaves and children at their religious ceremonies, to maintain a perpetual fire in their temples, and avowedly to worship the Sun. The only nation with whom they claimed relationship, and who are said to have spoken the same language, were the Taensas, a small tribe near the river, twelve or fifteen leagues above them. This nation disappeared shortly after the settlement of the country, uniting with the Tonicas, who seem to have been also a related people.*

The numerical strength of the Nache is very differently given by the various early authorities, the maximum being 200,000! More sober statements justify us in putting the number of fighting men in the whole nation at about 800 or even 500.

The origin or meaning of the name Nache is uncertain, and neither the Mâskoke or Creeks, nor the remnants of the tribe yet living can give any explanation of it. The former call them simply Nache or Nachvlke (the Nache people.) They have been known at times as the Apple or White Apple Indians, the Apple being the translation given the name of their principal village by the French. This village was twelve miles south of the present City of Natchez, three miles from the Mississippi, on Second Creek, and five miles from the French Fort, Rosalie. As early as 1699, D'Iberville speaks of them as "the Natchez or Tpelois," the latter word, properly Vpelois, being from vpe, meaning apple, or some such kind of fruit.

The attention which this nation has attracted from many writers interested in American Ethnology, and their hitherto unknown affiliations, have induced me to collect from various published and unpublished sources whatever can throw light on their relationship, and also to obtain

* See Penicaut, *Annals of Louisiana*, pp. 125-6; and Charlevoix, *Journal Historique*, p 433.

from representatives of the tribe still living an accurate vocabulary of their language, illustrating its grammar as well as its word-forms.

This latter had been very insufficiently done by previous writers. In the early French accounts, while we have many and ample descriptions of their villages, temples, ceremonies, government, arts and appearance, not a dozen words of their tongue can be found. Albert Gallatin published a short and imperfect vocabulary, which he obtained from a Nache Chief in Washington, and this, so far, has been the only source of information about the tongue. It was so meagre that no dependable conclusions could be derived from its study.

As a nation the Nache disappeared in 1730. They were the first to recognize the danger to the native population of the advent of the whites, and the first to resist their encroachments. They were also the first to suffer the inevitable destruction doomed ere many generations to overtake their whole race. The brief annals of their historical existence do not embrace half a century, and such as they are I append them, inserting references to the visits of those writers who have described them.

1682. March 26th.—The Chevalier de la Salle plants a cross at the Nache town of the Apple.

1699. Visit of M. de St. Côme and Father Francois Joliet de Montigny. The letters of both have been published by Mr. J. G. Shea.

1700. March 5th.—They conclude a treaty of peace with M. Le Moyne d'Iberville (Penicaut, *Annals of Louisiana*, p. 57).

November.—Visited by Father Gravier, whose letter has also been published by Mr. Shea.

1703. December.—Visited by M. Penicaut, with a war party sent out by M. de Bienville (*Annals*, p. 83).

1707. In company with the Biloxis and Pascagoulas they attack and nearly destroy the Chetimachas.

1716. "First war" with the Nache. They murder some French traders, and M. de Bienville marches against them to compel them to punish the murderers. Their warriors at this time estimated at 800. Fort Rosalie is constructed, finished August 5th. (See M. de Richebourg, *La Première Guerre des Natchez*, and Penicaut, *Annals*, pp. 131–2, both in French's *Hist. Colls. of Louisiana*).

1720. January 5th.—M. Le Page du Pratz, an intelligent young Frenchman, starts a plantation near the Nache towns. He subsequently writes a *Histoire de la Louisiane* (Paris, 1758), containing many particulars about the tribe.

1721. December.—Visit of the Jesuit Father Charlevoix, who records minutely his impressions in his *Journal Historique*, pp. 420–427.

1723. November.—Second war of the Nache (called by Du Pratz, the First.) Bienville with 700 (?) men attacks the village of the Apple.

1725. Death of the Great Sun, Olabalkebiche, the Stung Serpent.

1728. Fathers Poison and Le Petit undertake to convert them, but with indifferent success. A long descriptive letter of the latter in the *Lettres Edifiantes et Curieuses*, Vol. IV.

1729. November 28th.—The Nache attack and massacre the French residents, incited thereto by the demand of the commandant of Fort Rosalie, that they should forthwith vacate the village of the Apple, as he wanted the ground for his own purposes.

1730. January 27th.—They are attacked by the Choctaws, allies of the French.

February.—They are attacked by the French, their villages destroyed, and more than half their number either killed or taken prisoner. The captives were taken to New Orleans, where the women were put to work on the Government plantations. The men, including the Great Sun, were sold into slavery and shipped to St. Domingo to work in the mines, where they soon perished.

The remainder of the nation escaped across the Mississippi and fled up the Red River to a spot about six miles below the Nachitoche town, "near the river, by the side of a lake of clear water, still known as the Natchez lake, where they erected a mound of considerable size, which still remains."* Here they were attacked shortly afterwards by the French and the Nachitoches, under the command of M. de St. Denis. Many were killed, a number were driven into the lake and drowned, while the wretched remnant fled to the Chicasa and Creek towns. Although they have continued to speak their own tongue, they have never since attempted any separate organization.

The Nache language was described by the Le Page du Pratz as "easy in pronunciation and expressive in terms." He pretended to considerable familiarity with it, remarking in his chapter on the subject, "I readily learned the peculiar language of the natives." This we must accept with a very large allowance. The Nache, like most Indian tongues, is enormously difficult to a European, and all that M. du Pratz knew of it was probably little more than the current trader's jargon.

He is, I believe, the only author, however, who notes the different modes of speech in use in addressing persons of rank, and those of inferior position. His words in reference to it have been construed to mean that two languages were in vogue. This is not his statement. Indeed he is careful to guard against such an impression. He says, speaking of the dialectical differences between the Suns and the Commoners: "The two language are nearly the same; the difference of expression seems only to take place in matters relating to the persons of the Suns and Nobles, in distinction from those of the people."

The examples he gives, explain this at first sight singular anomaly. They are imperative or salutatory verbal forms. Now there are two

* Dr. John Sibley, in the *American State Papers, Indian Affairs*, Vol. I., p. 724. Dumont, *Mems. Hist. sur la Louisiane*, Tome. II., pp. 192, 193, 295.

forms in the Măskoke and some other Indian tongues in these modes, "the one used toward superiors indicating respect or veneration, the other toward an inferior as a servant or a child."* This peculiarity, probably developed in more positive features by a despotic government, constituted no doubt the difference observed by Du Pratz.

The vocabulary, which I now present, was prepared very carefully at my request by Mrs. A. E. W. Robertson, of the Tallahasse Mission, a most competent linguist, familiar with the Măskoke by practical use. It was obtained from Mr. Leslie, a pure-blood Nache. As he was unacquainted with English the Măskoke was employed as the medium, and the sounds are given in the alphabet of that language. This contains thirteen consonants and six vowels. The vowel sound of a in *fate*, the th, and the consonants b, c, d, g, j, r, q, v, x, and z, are wanting. The r is introduced to represent an aspirated l, as hl or 'l. The c is pronounced as tch in *wretch*. The w is always soft as in *weak*. The vowel sounds are a as in *fat;* e as in *me;* i as in *pine;* o as in note; u as in rule. The v is the neutral vowel, and is strictly ă short, as in *vocal*. In comparing the words with others in the Măskoke dialects, I have, however, substituted for the c the ch, and for the r the aspirated 'l. The kw of the Nache is pronounced as the English qu. The sh is always a combination, except in es-hok and pus-hvlles.

I have incoporated Gallatin's vocabulary, retaining his orthography, and indicating words from that source by adding after them the letter G.

Again	hvmv
All	lvtvse, latakop, G.
ant	wĕ'le
apple (big-peach)	vpesurer
arm	a'hvlv, ish, G.
ax	iyvmk, ohyaminoo, G.
arrow	eshakwo, G.
Back	u'sus
" lower part	okco'cu
bad	wvtvks, *or* mesmeskep, wattaks, G.
ball	puhshv
beans	popkĕ
bed	pĕ'tkup
bedstead	ha'pvtv'yv
bible (big book)	a'tolser
bird	sorkor, shankolt, G.
" young	sokolenu
black	cokokuph, tsokokop, G.
blackberry	onu
blue	haähsep, haasip, G.
book	a'tol

*Buckner, *Grammar of the Maskoke Lang.*, p. 77. I am informed that Mr. Buckner's explanation is not quite correct, but the fact is substantially as stated.

boy	kvpena′nu, tamunoonoo, G.
" small	tvmhkvpe′nanu
bread	pĕhĕ′lu, beheloo, G.
breath	heleksĕ′nēs
bear	tsokohp, G.
blood	itsch, G.
boat	kwagtolt, G.
body	iwit, G.
bone	ikwel, G.
brother	kakanesha, G.
buffalo	wastanem, G.
Cabbage	ki
cake	pĕhĕ′lu cvkv′lgup (globular bread)
cat	wenvtu
" young	wenvte′nu
chair	cu′speděl
chicken	kvbahtev′
" young	kvbahte′nu
chief	cu′nv, tarnwap, G.
chin	unkwvyv
circular	lutumkuph
clean	kahve′v
corn	ha′kuyv, hokko, G.
cow	wvstan
" calf	wvstanenu
cylindrical	lutugv
child	tsitsie, G.
cold	tzitakopana, G.
Day	we′tv, wit, G.
deer	ca′, tza, G.
" young	caye′nu
dog	wvskup, waskkop, G.
" young	wvskupenu
dress, (a)	pv′evlv
daughter	mahnoonoo, G.
Ear	ē′puk, ipok, G.
east	kwahsep, kakunef
eye	oktur, oktool, G.
earth (or land)	wihih
Fire	u′wvh, wah, G.
flowers	kvhvēlu′se
foot	a′tv
" broad part of	atpĕ′sev, hatpeshè, *feet*, G.
frog	ēcakst
father	abishnisha, G.

fish	henn, G.
friend, my	ketanesoo, G.
Ginseng (white medicine)	omkvhap
girl, large	horv
" little	hole'nu, hohlenoo, G.
good	sokonen, sokone, G.
grass	ĕ'wĕl, ohwell, G.
grasshopper	shela'tkĕha
green	poŏkup, chwellhayah, G.
God	aleksandiste tza, G.
Hair, or leaves	tŏyv
" (of the head)	ĕ'dĕn, etene, G.
hand	ĕ'sv
" the palm	ĕspĕ'hsĕv, ispeshe, G,
handkerchief	shemhawes
" large	shemhawesker
head	a'puyv, apoo, G.
heel	atv'ntcv
high	es'hvk
hog	kwĕ'hser
" young	kwĕhsele'nu
horse	wvskupser
" young	wvskupsele'nu
house	ĕ'dv, hahit, G.
heart	oontza, G.
hill	kweya, G.
hat	wahiloohie, G.
husband	tamahl nesoo, G.
Indian, red man	tvmh-pakup, tapakop, G.
infant	se'ce
ice	koowatanul, G.
King, or chief	cu'nv
kneepan	oksuyv
knife	pihĕwes, pyhewish, G.
Lake	a'hvyv
large	lĕkep, lehkip, G.
leg, lower part	atka'hkvr
" calf of	atwen'cev
life (breath)	heleksĕ'nĕs
lips	e'hecer
lizard	sakulcvcvt
" blue-tailed	ehepapv
leaf	tsiatoll, G.
lightning	pooloopooloonul, G.

Male	kvpe′nv
man	tvmh′kvpena′, tomhukpena, G.
many	tvlu′en, pookoseh, G.
meat	wen′cev, wintse, G.
medicine	omv
money	nvrkv′tuho′p
moon (white Sun)	kwa′hsep kvha′p, kwasip, G.
morning	tuwa′cen
mouth	e′heyv, heche, G.
muskmelon	yeweskmvtvk
mother	kwalneshoo, G.
Needle	a′tul
negro	cokonuh
night	mvyukuph, toowa, G.
north	cetakuph
nose	la′mve, shamats, G.
no	kooshats, G.
Oak	tssoelekep, G.
old	tapsel, G.
Pants	okvphv′sku
peach	vpesur
person	tvmh
" young	tv′myv
piebald	kvsahtēp
pillow	hĕ′sunts
pipe	hakhesk
place	luhu
plum	ahtvpesur
potato	vcv
pumpkin	yewe′skvyv
pine tree	tsohl, G.
Quickly	somōl
Rain	nvsv, nasnayobik, G.
rib	kutvpker
river (large water)	kuhnsher, wōl, G.
rock	o′fvh
red	pahkop, G.
Saddle	pĕtkupes
salt	wih
scissors	hvpha′wes
sea	wa′rv, kootshel, G.
" large	warsher
shirt	pofhesku
shoes	pupvce, popatse, G.
short	mocmockup

small	cekeskap, (pl) cekestanu (simg) tsikistik-tenoo, G.
snake	u'lv, woollah, G.
snow	rowiyv, kowa, G.
soap	kencuahvlles
sour	kvyumhkuph
south (warm place)	hvmepvstek
spherical	popupkup
stars	tuku'r, tookul, G.
stockings	ho'stcahawes
stove	uwvh-luhu
straight	svpupkup
sugar	owih
sun	kwahsep, wahsil, G.
sweet	cvkvlguph
sister, my	aluwuch, nesoo, G.
sky	nasookta, G.
son	akwalnesuta, G.
spring	amekone, G.
stone	ohk, G.
summer	amehika, G.
Table	kenhv'skushvpvt
tall, or long	wvtakuph, *or* wvtvntakuph
teeth	e'ntv, int (*tooth*), G.
thigh	a'nkwvyv
toad	waskv'lkul
tobacco	hakvu, hakshoo, G.
" pipe	hakhesk
to-day	kawet
tree	cuyv, tshoo, G.
turkey	sokorser
" young	sokorselenu
turnip (large cabbage)	ki'ansher
town	walt, G.
Valley	patkop, G.
Wagon	cetu'tukup
water	kuhn, koon, G.
watermelon	yeweskvyap
well ! (interject. of assent)	makup *or* makupiye
white	kahap, hahap, G
white man	royokup
wicked (person)	tvmhtvma'te
wild (of animals)	tvmhkoyugo
wisdom	helbunvlles
woman	tvmar, tahmahl, G.
" young (girl)	tvmalenu

warrior	kaastshel, G.
wife	stepe nesoo, G.
winter	kwithitsetakop, G
wolf	uttuwah, G.
wood	tshootop, G.
Yellow	hahiahop, G.
yes	mahkoop, G.
young	tapkoppinah, G.
I	tugēha, tukehah, G.
thou	uhkehah, G.
Ive (this here)	akoonikia, G.
we	tukahanehi, G.

NUMERALS.

One	we′tan	witahu,	G.
two	a′wete	ahwetie,	G.
three	ne′de	nayetie,	G.
four	tenv′wete	ganooetie,	G.
five	spē′de	shpedee,	G.
six	la′hvnvf	lahono,	G.
seven	un′hkwv	ukwoh,	G.
eight	v′pkvtepes	upkutepish,	G.
nine	wete′pkvtepes	wedipkatepish,	G.
ten	ogu	ōkwah,	G.
eleven	ogu wetan koü′se		
twelve	ogu āwete koü′se		
thirteen	ogu nē′de koü′se		
fourteen	ogu tenv′wete kou′se		
fifteen	ogu spēde kou′se		
sixteen	ogu la′hvnvf kou′se		
seventeen	ogu vnhkwvk ou′se		
eighteen	ogu vpkvtepeskou′se		
nineteen	ogu wetep kvtepes kou′se		
twenty	ogaphv	okapoo	G.
twenty-one	ogaph wetan kou′se		
thirty	ok nē′de		
forty	ok kenvf		
fifty	ok spēde		
sixty	ok la hvnvf		
seventy	ok vn h kwv		
eighty	ok vpk vtepes		
ninety	ok wete pk vtepes		
one hundred	pu pu we′tan	poopwitahu,	G.
two hundred	pupu a′we′te		
one thousand	puputvmse we′tan	pooptalshel,	G.
one million	pupu tvmser we′tan		

Verbal Forms.

To see	erhvlles
to write	pushvlles
to die	hawvteës (*sing.*), wewvteëkek (*pl.*)
to kill	tahanks (*sing. obj*), wewvthvlles (*pl. obj*), appawe, G.
to hear	eplehvlles
to lift	hëkërhvlles
to sweep	përhvlles
to wash	cuahvlles (see *soap*).
to cleanse	kahvhvlles (see *clean*).
to blacken	cokohvlles (see *black*).
to sit	hë′ces (*sing.*), hëtukses (*pl.*).
to stand	cashvkes (*sing.* and *pl.*).
to come	kahvsahkus (*sing.*), hvhapesahkus (*pl.*).
to run	kwvrhës kus (*sing.*), hëkërhvkes (*pl.*), kwalneskoop, G.
to be lost	wvthvkes (*sing.*), wvtvhvkes (*pl.*)
to be about	hv′petes (*s.*) ; hvpe′kses (dual) ; wehvkes (*pl.*)
to go	hahtes (*s.*) ; haksës (*d.*) ; pëhëgus (*pl.*)
to have come (?)	hvëhtek (*s.*) ; hvëksek (*d.*) ; kvpeëkuk (*pl.*)
to lie down	hv′ces (*s.*) ; hvtv′nces (*d.*) ; hvlvhv′ces (*pl.*).
to eat	kenhvskus, kimposko, G.
to drink	pokoo, G.
to sleep	nanole, G.
to walk	naktek, G.

Indicative Forms.

I want	tëgusa
thou wantest	pënëgusa
he wants	nëgusa
we two want	tëtënëgusa
we want	tëpëgusa
we all want	lvtvse tëpëgusa
you want	pëmpëgusa
they want	nëpëgusa
dost thou want?	pënëguse?
do ye want?	pëmpëguse?
do ye all want?	lvtvse pëmpëguse?
what dost thou want?	kŏs pënëguse?
do you want water?.	kuhn pënëguse?
I want to eat	kenhvskus tëgusa
I want to eat bread	pëhëlu hvskus tëgusa
do you want to go	hahtës pënëguse?
I want to go	hahtës tëgusa
we two want to go	hakses tëtënegusa
we want to go	pëhëgus tëpëgusa
we two want to go out	weteshvtvnges tëtëne′gusa

we want to go to the river	warvgus pĕhĕgus tepĕgusa
I want to go and come back this very day	hahtes kawe′tvwv kahvsa′hgus tĕ′gusa (to go) (this very day)(to come back)(I want)
I went and came back	e′htene kvkv e′sahgu
we went and came back	peĕkune kvkv ē′pe sahgu
we want to go (*or*, to be) about	hvpekses tĕtĕne′gusa
we all want to go (*or*, to be) about	lvtvse wĕ′hvkes tepĕgusa
many are sitting	kaku′ĕge tvluen
have you any?	nvcepsev?
I have	nvcecv.
the girls all want books	tvmar lvtvse nĕpĕgusa atul
I want to give to all wanting books	lvtvsets nepegusa atul naguses tĕgusa
he excels all	lvtvse pukeluse
to know	hvcoko′wes
I know	tacuka
I do not know	estucoko
know thou	pĕlecoko
to cast away	mehvlles
cast (it) away (imp. sing.)	mehpale
cast (it) not away	mvkvmmehpvl
run thou	kwvrpĕsku
run thou quickly	kwvrpĕsku somōp
go thou	pa′hte
go you two	pa′kse
go ye	pĕpĕgu
give to me	kvba′guce
bring to me	hvbagece
he died	kae′wete
he fell down	mvkvce′ak
let us all go and see it	pĕĕguk lvtvsets erhvles tepĕgusa (going) (all) (to see) (we want)
I am going	tahtva′
to day I am going	kawet tahtva′
now I am going	kawetvn tahtva′
we two want to go and come back this very day	aksek kahvsa′hgus tĕtĕ nĕgusa (having gone) (to come back) (we two want) ka′wetvwv′ (this very day)
having gone, he returned	e′htene kv′kvkuno′wesku
many came (yesterday)	tvluen kvkvepe sa′hku
long ago they came	ĕlĕ′nĕĕn kvkv-supesahku
we two want to run	awe′nu kwvrhĕ′skus tĕtĕnĕ′gusa
I don't want to be lost	wvthokes ekusattaá

he was lost	kawv'tege, *or* kawvtsugu
we two don't want to be lost	awe'nu wvthvkes ekusativtvnea'
I having gone, when you you come back, I again will go	pahtek kvbvsa'hkup tvgĕ'ha hvmv maa'tek
I am he, *or* that one	manv ta'v
you are he, *or* that one	manv pvna'a
he is that one	mana a
they are those	manv pvmpeya
do you think it is he?	mana a yepvnuwv?

It will be seen that many of the words in the above vocabulary are compounds. Thus wās, apparently a generic term for a certain class of animals, appears in the words wvs-tan cow, wvs tanenu calf, was tanem buffalo, wvs kup dog, was kv'lkul toad, wvs kup-se'l horse, and by elision of the last consonant in we nvtu cat (wvs e'ntu teeth?), and wĕ 'le ant. I know of no such root in the Chahta-Māskōke dialects, but in the Yuche we have a similar series in the form wĕ, we-tenĕ cow, we-yu deer, we-eyu chicken, we-chaw hog, which latter seems the Natchez kweh-se'l hog (se'l the augmentative).

The termination kuyv seems to be similarly generic for edible vegetables, as ha'kuyv corn, yewe's kuyv pumpkin, yewes kvyap water-melon (compare yewes kmvtvk muskmelon).

U'wvh, fire, otherwise spelled wah, and oua, appears in kwahsep, wah sil or oua chil sun, kwa'hsep kvhap moon, wahiloohie G. hot, (from u'wvh, and luhu, place).

A'tv, foot, forms by addition at'vntchv heel, atwen'chev calf of the leg (wen' tchv, meat or flesh), atkahkvr leg, popatse shoes.

Wihih earth, wih salt, and owih sugar, seem allied, the two latter substances probably being regarded as some kinds of earth.

The name of God given by Gallatin is evidently from heleksĕ'nēs breath, and is doubtless a translation of the Mas. E svketv emise, Master of Breath. My informants distinctly say the Nache contains no word for God, of native origin.

The accented é before words denoting parts of the body (see mouth, hand, hair, ear, teeth) occurs also in Mās., where it is usually translated *his*, or *the*, as impersonal. The terminal nesoo is also the possessive form from ne, he.

The words for thunder and lightning are distinctly onomatopoetic.

In several instances totally different words are given in the two vocabularies, as for arm, bird, boy, chief, night, etc. These doubtless express different but allied ideas.

There are but few plural forms. The word *tvluen*, many, is generally used with the singular to form the plural, as *lekep tvluen*. Diminutives

formed by adding *enu* (also a diminutive termination in Măskoke); and augmentatives by adding se'l are frequent.

Causative verbs are numerous, and are generally formed by the termination *hvlles* to the root. Eple hvlles, to hear, is probably thus formed from *epuk*, the ear. Adjectives and some possessive pronouns follow the low the words they qualify.

The numerals are remarkably simple, and testify to their independent construction in the language itself. The word for one, we'tan, witahu, G., seems allied to a Maskoke word sometimes used for first, hvti-chiskv (= wŭte-chiskv).* The latter again leads us to the Yuche hetĕ, one. The number two is merely this primitive repeated with a prefix, a' wete, probably *get one*, or one other, as the German *noch eins*. Three is the same root eta, with the prefix of the third person singular, ne'de, or nay'etie, G., he yet, *er noch*. Again, in the four, tenv'wete, we recognize the word two, a'wete, with the dual prefix te and a euphonic n, te-n-awete, tenv'wete, literally, two twos. The five, spē'de, or shpedee, G, is evidently the palm of the hand held up to show the five fingers ēspe'hsev, ispeshe, G. (see the vocabulary). Seven, eight, and nine are clearly built up on the root kwv, thus un'h kwv, v'p kwv tepes, wete'p kwv tepes. This radical is common also to these three numbers in the chetimacha, pakhu, tsi khuiau, tek khuian, and the Attacapa eight and nine, ku eta, ku icheta. The ten ogu, oku, is possibly the Chok. *pokoli*, Mik. *pokolen*, ten. Indeed, Dumont gives *pokole* as the Nache word for ten.

In instituting a comparison between the Nache and other tongues, the Chahta-Măskōké stem of languages, which included those spoken over most of the area between the Lower Mississippi and the Atlantic, naturally should first be examined. The principal dialects are the closely related Choctaw and Chikasaw on the one part, and the nearly equally closely related dialects of the Creek or Măskōke on the other, the latter embracing the main Creek or Maskoke proper, the Hichita, Mikasukie, and Koösati.

There are no published dictionaries of any of these tongues, and the vocabularies are by no means full. Besides the printed lists of words to be found in the writings of Gallatin, Buckingham Smith, Buckner, Robertson, Schoolcraft, and Byington, I have consulted various manuscript vocabularies, especially one of the several Maskoke dialects, obtained at my request by Mrs. A. E. W. Robertson. The dialects are referred to by their first syllables.

Again, hvmu—Mas. svnv *chumv*.

Apple, vpesurer, augmentative of vpesur, peach. The prefix vpe is the Choctaw affix vpi, applied to various kinds of fruit-trees, as ot-vpi chestnut tree, fik vpi, fig tree (Luk. xviii. 6).

Beans, popkĕ. Seminole, popka, wild peas.

Bed, pĕ'thup. Mas. pvtakv.

* H. F. Buckner, Grammar of the Maskoke Lang. p. 28.

Ball, puhshv. Mas. pukko.

Bird, so'lko'l. Mas. su'li, a bird of the buzzard species, as fuchō-su'li, a buzzard duck.

Blackberry, onu. Chŏk. vni, small fruit, berry.

Boy, kvpena'nu. Mas. chepvne ; the termination enu is diminutive.

Bread, pĕhĕ'lu. Chok. paska. Mik. pvlvste.

Blood, itsch. Hit. bitch-ikchee.

Brother, kaka-nesha. Mik. chachaie (my).

Deer, cha'. Mas. icho.

Eye, oktul. Măs. tu'lwv.

Flowers, kvhvĕlu'se. Chok. pokauly.

Fish, henn, G. Chok. nvni.

Frog, ĕchakst. Chok. shukvti.

Girl, or young woman, ho'lv. Mik. hvlke.

Good, sokonen. Kos. kokanu.

Hair, or leaves, toyu. Sem. tuisi, leaves.

House, hahit, G. Mas. ehati (his home).

Large, lēkep. Mas. 'lokket.

Lips, See mouth.

Male, kvpen'v. Mas. chepvñe, boy.

Many, tvlu'en. Mas. tvlkōs, it is all ; tvlkekōs, it is not yet all, not only.

Medicine, omv. Chok. vpol *uma*, a medicine man.

Mouth, heche, G. Mik. eichi. Chet. cha. This is apparently the word for lips, e'hech'l.

No, koo-shats, G. Mas. ka, or kō.

Peach, vpesur. See Apple.

Plum, aht-vpesur. See Peach.

Potato, vchv. Mas. vhv.

Pine tree, tsohl, G. Mas. chole.

Sea, wa''lv. Mas. wv'lakko, from oewv water and 'lakko great. Koot-shel, G. Chok. okhuta pond, with augmentative, sel.

River, wa'lshe'l, Mas. wa'l with augment. sel. See Sea.

Small, chekestanu. Mas. chetke (enu, the diminutive suffix). Chok. iskitinĕ.

Sour, kvyumhkuph. Mas. kvmŭksi

Stars, tu'kul. Mas. vkolaswv

Sweet, chvkvlguph. Mas. chvmpe

Teeth, e'ntv. Mas. enŭtti, Mik. enote

Tobacco, hakshoo, G. Mik. akchvme'
" pipe: from same root.

Tree, or wood, chuyv, tshoo, G. Probably allied to tsohl, Mas. chule, pine tree.

Wolf, uttuwah. Mas. yvhv

Words from early French Authors.

A very limited number of words are given in the early French writers. These I have collected and will examine.

Allouez, Watchers, guards; "leurs Gardes qu, on nomme Allouez," Charlevoix, *Journal Historique*, p. 420. No doubt this is from e'lhvlles, to see, and hence to watch.

Athiocma, that is good, "cela est bon" (Dumont, *Memoire Historique sur la Louisiane*). This is obviously the Chahta achvkma, good.

Caheuch, come (Du Pratz). Evidently from kahvsahkus, in the above vocabulary.

Chichicois, gourds used as rattles (Dumont, I, p. 193).

Choupichoul, a kind of grain, millet.

Coyocop, Spirit, Esprit (Du Pratz). With the affix se'l or chil, great, the Great Spirit; prefixed to techou, or thecou, servants or inferiors, the common appellation of the inferior divinities (Du Pratz). Given in my vocabulary as the word for white man 'loyocop.

Coüy-oüy, the cardinal bird (Dumont).

Hoo! hoo! or hom! hom! An interjection of approval or assent (Du Pratz and Dumont). This is the same in Măskoke (see Buckner, *Maskoki Grammar*, p. 74).

Liquip, man or chief (Dumont). This is an error, as the word is clearly lēkep, great or large.

Miche-miche-quipy, an opprobious name applied to the lowest caste (Du Pratz), called Puants or Stinkards. I suspect this is an Algonkin word, from the Shawnee miche, bad, mean, and que-essan boys, fellows. A miserable remnant of Shawnees were held as slaves by the Nache (Penicaut, *Annals*, p. 123). Moreover the author of the *Voyaye à la Louisiane*, p. 33, says the native name is *olchagras*.

Nou-kou, or No-co, I do not know (Gravier, *Letter*, p. 142, and Du Pratz). Compare the vocabulary.

Oüa, fire; oüa-chil, sun. These will readily be recognized.

Pocolē, two at a time, "en dix" (Dumont). This is the Mās. pokole, ten.

Tallabē, very many; "il y en a tant que je ne puis plus les compter" (Dumont).

Tamail, woman or wife (Gravier, *Letter*, p. 141, and Du Pratz). Properly tvma'l.

Tecou, servants, inferiors; ouchil-techou, servants of the Great Sun, employed to convey his orders to the various villages. They were two in number (Penicaut, *Annals*, p. 91).

Du Pratz gives the following examples of the difference between the dialects of the nobles and common people.

Hark ye	to a noble	magani
	to a commoner	aquenan
Are you there?	to a noble	apape-gouaiche
How do you do?	to a commoner	tacthte-cabanacte
Sit down	to a noble	cahan
	to a commoner	petchi

Of these, the first two are similar, except the prefix m. The last word is from hē'ches, to sit. The others are too uncertain in form to allow of identification.

The proper names preserved in various writers are few in number. I have noted the following:

Olabalkebiche, the Stung Serpent, le Serpent Piqué, the Great Sun, who died in 1725. The first portion of the name is vlv, serpent.

Oyelape, the White Earth, la Terre Blanche, name of a Sun. Given the full French sound we may suppose it formed of wihih earth and kahap white.

Ala ho fléchia, name of a chief (Richebourg, *La Première Guerre des Natchez*, p. 247).

Chinuabie, name of the "Great Natchez Warrior" in 1792 (*American State Papers, Indian Affairs*, Feb. 17, 1592).

Is-sa-laktih, name of the Chief of whom Mr. Gallatin obtained his vocabulary.

Jenzenaque, the name of one of their villages (Dumont).

It is very evident from this examination, incomplete as it is, that the Nache is a dialect of the Māskoke or Creek, changed in various respects, with a small percentage of totally foreign roots, but distinctly recog-

nizable for all that. This conclusion is indeed the opinion of the Creeks themselves, as they told William Bartram,[1] nearly a century ago, that "the Natchez was a dialect of the Muscoculge," as he calls the Mäskoke. There is, further, no reason to doubt but that the great mass of the nation were of Mäskoke lineage. The only point in which they differed essentially from the tribes around them was in the despotic character of their rulers. Many other of the Chahta-Mäskoke tribes were nearly equally civilized. The Yasous, Coras, Offagoulas and Ouspie erected mounds and earthworks for their villages[2], as, indeed, did most of the Creek tribes; the so-called "Temple" and the perpetual fire kept therein, were customs common throughout the Mäskoke country[3]; the Nache celebrated the feast of new corn just as the Creeks did, and, according to Du Pratz's description, with very similar ceremonies; while the title "Great Sun" was so far from a strange or unusual metaphor to apply to a chief that, for instance, the Delawares conferred it on Col. Daniel Broadhead in 1781[4].

The body of roots wholly dissimilar from any I have been able to find in the Chahta-Mäskoke dialects, embraces a number of important words, and makes up a sufficiently large percentage of the language to testify positively to a potent foreign influence. In what direction we are to look in order to find analogies for them, and thus, perhaps, throw light on the origin of the despotic government of the Nache and some of their peculiar customs, I shall not at present discuss.

AN ACOUSTIC PHENOMENON IN THE ROCKY MOUNTAINS.

(*Read at the Meeting of the Philosophical Society, Nov. 7th*, 1873.)

On the eighth day of August, 1873, a party of four, ascended Bald Mountain, one of the loftiest summits of the Wahsatch Range, bounding Salt Lake valley on the east. It rises nearly four thousand feet above the Mining Camp of Alta, and over twelve thousand above the level of the sea. The shady gulches of the mountains were still patched with snow, around which acres of wild flowers during this, their tardy spring, were blooming in lavish profusion.

As its name imports, vegetation nearly ceases some hundreds of feet from the top of the mountain, partly owing to its extreme elevation, and partly to its destitution of soil. Its top had withered into a more or less spherical form, and was shingled with disintegrated shale—(about

1 *Travels through North and South Carolina*, etc., p 463.

2 De La Harpe, *Annals of Louisiana*, p. 106.

3 Interesting particulars respecting these customs are given by William Bartram in a MS. in the possession of the Penna. Historical Society.

4 Heckewelder, *Narrative of the Mission of the United Brethren among the Delaware and Mohegan Indians*, p. 218.

the average size of bricks)—and was *very* sparsely interspersed with grass.

Whilst resting some two hundred feet from the summit, on the north-east flank (during a moderate breeze from the south-west) we were surprised by a loud roaring noise proceeding from the other side, precisely similar to that of an express train when crossing a bridge, or passing a rocky wall. It continued for the space of several seconds, exciting various surmises as to its character and cause. Prior to its occurrence not a sound disturbed the pulseless silence. All agreed that it resembled the rush of a railway train, a clap of thunder, or an avalanche of rocks down the mountain side. Hurrying forward to ascertain the facts, nothing whatever could be discerned to furnish a clue to them. The day moreover was perfectly clear,—not a cloud upon the horizon ; and the theory of a clap of thunder was accordingly abandoned. It was suggested that the goblins, who in the days of Rip Van Winkle played nine-pins on the summits of the Kaatskills, might possibly have emigrated like the Mormons to this sequestered spot, and had been nearly surprised at their accustomed game. In a few moments more, however, the phenomenon occurred again, and in this instance to the abundant satisfaction of us all.

A petty whirlwind, such as dashes along our dusty roads in summer, flitted past within some twenty feet, accompanied by a similarly boisterous noise, although not so prodigious as in the first instance. Their identity, however, was unequivocal ; for, bare as the mountain was, the wind was enabled to collect enough of dust to render its gyrations distinctly visible. This was followed by two or three others of like character during the half hour of our stay, but each apparently less noisy than the last. As the sun had just passed the meridian this fact might possibly account for their diminishing energy.

As the second was sweeping by, the writer—in order to measure the violence of its winds—rushed into its vortex. It was not traveling faster than spirited walk, and was about a yard in diameter. Its vertical current, however, was sufficient to invert the skirts of his frock-coat above his head, although its pockets were loaded with specimens of silver ore to the extent of at least one pound each. His hat required to be firmly secured, and although there was not force enough in the wind to disturb his equilibrium otherwise, its effect on the earth's surface developed a noise like that of a quick-moving empty cart over a stony pavement. The loudness of the clamor appeared to be in each case in exact proportion with the violence of the wind, and it is a notable and well established fact, that in distructive whirlwinds, such as tear up trees, the accompanying roar is that of the most appalling thunder.

Having in no instance heard of these phenomena, as occurring on the scale, and under the circumstances here mentioned, the writer deems it well to impart the facts for the due consideration of the curious.

P.

ON THE METEORS OF JANUARY 2ND.

By Professor Daniel Kirkwood.

(*Read before the American Philosophical Society, November 21st*, 1873.)

The second of January was first designated as a meteoric epoch in 1839, by the late Edward C. Herrick, Esq., of New Haven, Connecticut. Modern observations of this shower have not been sufficient to determine the rate of its nodal motion: it may be worthy of remark, however, that a progressive movement equal to that of the meteors of November 14th, would bring the display of December 2d, A. D. 848, forward to the epoch of January 2d. The dates of the star showers derived from this swarm, the first being doubtful, are as follows:

1. A. D. 848, December 2d, assumed to correspond to the modern epoch of January 2d.*

2. 1825. On the morning of January 2d, a shower of falling stars was seen in Tuscany, Italy. During the display, about five o'clock, a brilliant fireball appeared, which was doubtless derived from the same meteor group.†

3. 1835. On the 2d of January, according to M. Wartmann, an extraordinary apparition of shooting stars was observed at Mornez, near Geneva.‡

4. 1838. January 2d, a similar display was reported by the same observer.§

5. 1839. M. Bravais states that the night of January 2d, 1839, was very remarkable at Bossekop, in Finland, for its great number of shooting stars and a magnificent aurora.‖

6 1840. On the night of January 2d–3d a great number of meteors were observed toward morning by M. Duprez, at Gand. At the same time a bright aurora was seen at Geneva, and magnetic perturbations were noticed at Prague.¶

7. 1862. A shower of meteors was seen at New Haven, Connecticut, on the morning of January 2d. About four o'clock, as many as three per minute were seen by one observer.**

8. 1863. On the morning of January 2d, Mr. Stillman Masterman, at Weld, Franklin County, Maine, saw meteors falling at the rate of 48 per hour. On the morning of the 1st, also, they were unusually numerous.††

9. 1864. January 2d, R. P. Greg, Esq., of Manchester, England, and Professor A. S. Herschel, "mapped each about 60 meteors in two hours."‡‡

10. 1865. "On the morning of January 2d, 1865, shooting stars were sufficiently numerous to attract the attention, at New Haven, of those who were not aware that unusual numbers were looked for on that morning."§§

* Quetelet's Catalogue.
† Silliman's Journal, March, 1862, p. 290.
‡ Quetelet's Catalogue. § Ibid ‖ Ib. ¶ Ib.
** Silliman's Journ., March, 1862, p. 290.
†† Silliman's Journ., January, 1863, p. 150.
‡‡ Ib., May, 1864, p. 445 §§ Ib., March, 1865, p. 251.

More observations will evidently be necessary to determine the period. The preceding dates, however, may all be represented in the following scheme:

A. D. 849 to 1825.....75 periods of 13 years.
1825 to 1838..... 1 period of 13 "
1838 to 1864..... 2 periods of 13 "

It seems, therefore, somewhat probable that the meteors of this group complete a revolution in about 13 years. The showers of 1835–40 indicate, moreover, that the cluster has become so much extended as to occupy five years in passing the node. With a period of 13 years we find the

Mean distance..... = 5.53
Aphelion " ..... = 10.06

or nearly equal to the distance of Saturn.

In the *Astronomische Nachrichten*, No. 1632, Dr. Edmund Weiss, of Vienna, called attention to the fact, that the fourth comet of 1860, in its ascending node, approaches very near the point passed by the earth about the 3d of January. The elements of this comet according to Valz are as follows:

Perihelion Passage.....1860, Sept. 28.
Longitude of perihelion.....110° 59′
Longitude of ascending node.....104° 14′
Inclination..... 28° 14′
Perihelion distance..... 0.9537
Eccentricity..... 1.0000
Motion..... Retrograde.

The comet was discovered by Tempel, at Marseilles, on the 23d of October. It was very faint, and but four observations were obtained. It had an apparent diameter of from three to four minutes. Its light was "not uniform, but scattered like a small cluster of very delicate stars, insomuch, that the discoverer was for some time doubtful whether it was really a comet." The body in this respect had a striking resemblance to that of 1866, which is associated with the meteors of November 14th.

According to M. Valz the orbit of the comet of 1860 (IV) is a parabola. The observations, however, which were very imperfect, could be perhaps as well represented by elliptic elements. If it is really the source of the January meteors, its periodicity must be regarded as at least highly probable. It is remarkable, moreover, that on the hypothesis of elliptic motion, the longitude of the comet's descending node differs less than 8° from that of its aphelion. The latter point is, therefore, very probably near the orbit of one of the major planets.

If the period be thirteen years, the comet should have returned in the latter part of 1873, and the maximum fall of the associated meteors should occur about 1877.

A STUDY OF THE STRUCTURE AND EROSION OF BRUSH MOUNTAIN, IN BLAIR COUNTY, PENNSYLVANIA (With a Map).

By J. P. Lesley,

Professor of Geology in the University of Pennsylvania.

At one of the meetings of the Society in the summer of 1873, a proof copy of the Map of Brush mountain, bound into this number of the Proceedings, was exhibited to the members, and its most interesting features pointed out.

No detailed description of it seems necessary. Those who are conversant with Topography in its application to Geology will find sufficiently plain indications of the state of things at the Tyrone City Gap and along the Little Juniata River, displayed by the ten-foot contour-lines of the topography, and by the three small vertical sections placed near the geographical points where they were made.

The system of thick and thin contour-lines on the dark and light sides of hills, to bring them into relief, is one which I invented about the year 1855, using it on a large scale for the first time in the construction of my elaborate Maps of Fayette and Westmoreland Counties, made for the Pennsylvania Railroad Company. The effect upon the portraiture of five hundred square miles of that strongly accidented country was very fine ; and was obtained without in any measure sacrificing the scientific accuracy of the work. I have pursued the same plan ever since, and teach it in the Geological laboratory of the Scientific Department of the University.

The Map here given is a heliotype reduction to one-third (linear) of the original drawing, made by James Osgood & Co., of Boston. It is therefore a fac simile ; and every error is exhibited. The only one needing designation is of a grave character, and I hope to present a correction of it at some future time. The narrow, straight and deep little valley which heads southwest between the crests of the mountain, and issues northeast at the centre of the Gap, is not straight at its mouth. It bends down stream somewhat, allowing the southeast shoulder of the northwestern ridge to project into the Gap, in the same style as does the southeast crest ridge on the opposite side of the Gap ; only in a reverse direction ; that is, down stream instead of up stream. This may be considered a venial error of detail, but it is not ; for it casts a shadow on the demonstration that the erosion of any one part of Apalachian land-surface relates itself harmoniously with the general erosion of its district ; and yet is differentiated by exceptional parts of structure. The short ravine splitting the mountain on the northeast side of the Gap would have bent southward at its mouth, like the long ravine opposite to it, but for a crush in the red rocks of IV., caused

by the same force which has thrown the whole mountain on that side of the river forward (northwestward) about two hundred yards.

This upthrow fault, plainly exhibited by the Map, has undoubtedly determined the point at which the drainage of the Upper Little Juniata River had to pass the outcrop barrier of the vertical measures of IV (Middle Silurian) now constituting the double crested mountain, called Brush Mountain northwest of the Gap, and Bald Eagle Mountain northeast of the Gap.

There are similar faults connected with the issuing points of the Little Juniata and of the main Juniata at their gaps through Tussey Mountain, which forms the descending (S. E.) outcrop of the same measures on the other side of the great anticlinal, ten miles further to the southeast.

Stated Meeting, December 19th, 1873.

Present, 27 members.

Vice-President, Mr. FRALEY, in the Chair.

A letter acknowledging the reception of his diploma of membership was received from Il Commandatore Prof. Giovanni Capellini, Direttore delle Museo Geologico della R. Universitá, dated Bologna, Nov. 28th, 1873.

A letter acknowledging the receipt of Proceedings of Am. Philos. Society, Nos. 88, 89, was received from the Bureau des Longitudes, dated Observatoire National de Paris, July 29th, 1873.

A letter acknowledging the receipt of Proceedings No. —, and announcing the envoy of the Bulletin of the Mexican Geographical Society, was received from the first Secretary, Sig. Ignacio M. Altamirano, dated Mexico, Oct. 31, 1873.

Donations for the Library were received from the Royal Prussian and Belgian Academies, the Geographical Society and Revue Politique of Paris, London Nature, the Literary and Philosophical Society of Quebec, the Essex Institute, Silliman's Journal, the New Jersey Historical Society, the Franklin Institute, American Chemist, and American Journal of Pharmacy, Coe, Wetherill & Co., of Philadelphia, and the Geographical and Statistical Society of Mexico.

The death of a member, Mr. George C. Schaeffer, at Washington, October 4th, aged 59, was announced by the Secretary.

The death of a member, Louis John Rudolph Agassiz, at Cambridge, Mass., December 14th, aged 66, was announced by Dr. LeConte. On motion, a committee was appointed to

prepare suitable resolutions to express the regret of the members of the Society at the loss. The Committee consists of Dr. LeConte, Mr. Lesley and Dr. Carson.

Mr. Holman exhibited, by request of the members, his new method for observing the circulation of the blood, by throwing upon a screen a lime-light image of one water-animal after another, enclosed between two glasses. Cavities are ground out of the glass-slides, of a size and shape to fit the animal's body, restrain its movements and permit the transparent tissue to be focussed on the screen. To protect the creature from the heat a simple apparatus, of india-rubber tubes, permits a constant current of cold water to pass around the subject between the glasses.

On motion of Mr. Walter the thanks of the Society were tendered to Mr. Holman for the very interesting exhibition with which he had obliged the Society.

Mr. Blake presented to the Society, in the name of the Swedish Commission at Vienna, a copy of a work entitled "Results of an experimental inquiry into the mechanical properties of steel, &c, manufactured by Christian Aspelin, Esq., Westanfors and Fagersta Works, Sweden," by David Kirkaldy; illustrated by plates. London: Testing and Experimental Works, Southwark St., S. E., 1873.

He described Kirkaldy's magnificent exhibition in the building at Vienna, and directed the members' attention specially to the distorted circles and squares (engraved on annealed and unannealed steel plates) after tension, proving visibly the universal distribution of the strain and consequent movement of molecules throughout the mass of steel. He thought that an important conclusion might be drawn from this by the physicist discussing such questions in geology as that of the elongation of pebbles in conglomerate rocks.

A discussion took place among the members present, par-

ticipated by Messrs. Briggs, Lesley, and Rand, and by Dr. R. E. Rogers.

Mr. Blake based his arguments on such facts as those which he had observed, in examining the so-called "Gravestone" slates of California, and pebbly conglomerates of Arizona, in which, he alleged, all the quartz pebbles lying in a mica slate matrix were evidently elongated in one direction. He did not agree with the late Dr. Hitchcock in calling in the intervention of heat and moisture to account for the elongation of the Vermont and Rhode Island pebbles in conglomerate; for Kirkaldy's plates were of cold steel. Physicists must accept as a law the plasticity of all matter, even in a dry and cold state, under sufficiently exacting conditions of pressure and time.

Dr. Rogers considered such an hypothesis very hard to entertain. He did not believe the alleged fact of the elongation of pebbles in conglomerate rocks. The shape of the Newport pebbles was certainly given to them by attrition on the sea beach before the consolidation of the deposits. The elongation of a quartz-pebble in a softer matrix is impossible, because the power exerted can have no firm hold on the pebble, which may change its place in the yielding matrix, but without changing its shape. A conglomerate must be homogeneous like a mass of steel to exhibit the effects portrayed by Kirkaldy, and no such conglomerate exists.

Mr. Lesley agreed with Dr. Rogers in this opinion; but adduced such facts as the sigmoid flexures in gneiss and mica slate rocks, to show that quartz string-veins are sharply bent without fracture, proving the plasticity of quartz. Sometimes these zigzags are so numerous and the plications so sharp, that, if pulled out straight, an unbroken quartz vein would extend hundreds of feet. He said that once, in company with Mr. Edouard Désor, he had found upon the outcrop of the coal measure conglomerate the impression of

a calamite stem, crossing matrix and pebbles alike, impressing the quartz pebbles precisely as it impressed the cement between them. He believed in the plasticity of all matter, and that, if we could devise machinery for securing a diamond in a grip strong enough, we could elongate it like steel.

Mr. Briggs reminded the Society that Kirkaldy's visible demonstration had been theoretically anticipated by L'Aimée in his rare and too little known Treatise on Strains within the limits of Elasticity. Indeed, some of Kirkaldy's results are depicted in that work. Mechanical philosophers are apt to assign too high a value to such realistic demonstrations, and too low a value to proofs and conclusions obtained through transcendental mathematics.

The Chairman of the Finance Committee reported the following appropriations for the ensuing year, which, on the recommendation of the Committee were so ordered:

Salary of Librarian	$700 00
Assistant Librarian	360 00
Janitor	100 00
Binding Books	200 00
Subscriptions to Journals	50 00
Insurance	200 00
Hall Committee	200 00
Petty Expenses of Librarian	150 00
Publications, in addition to the interest on the Publication Fund	2500 00
General Expenses, including the commissions of the Treasurer	850 00
	$5310 00

Pending nomination No. 740, and new nominations Nos. 741, 742, 743, 744 were read;

And the meeting was adjourned.

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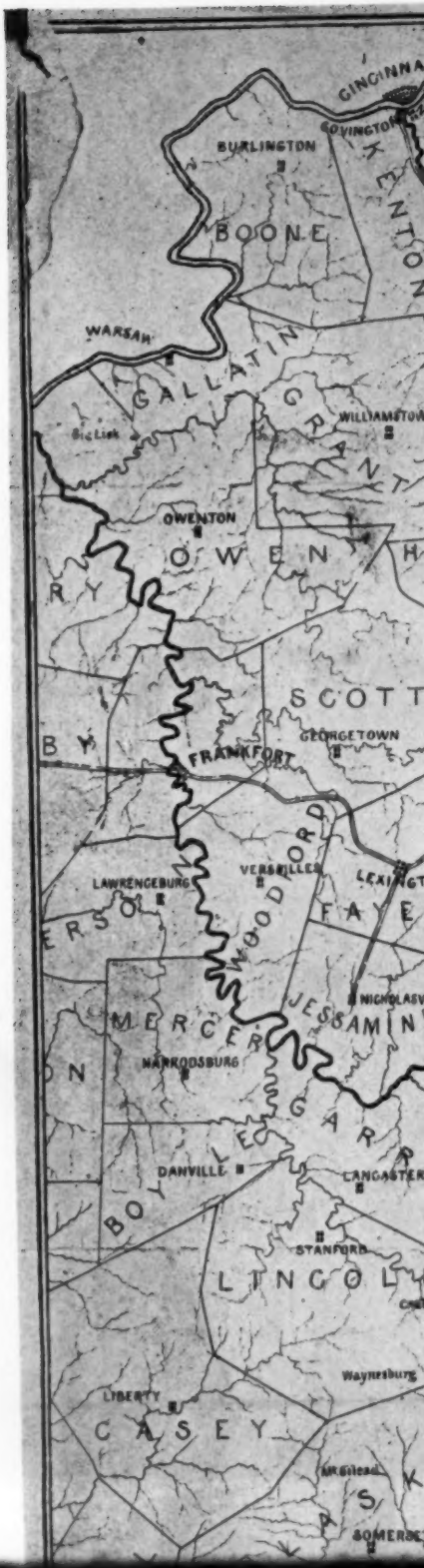
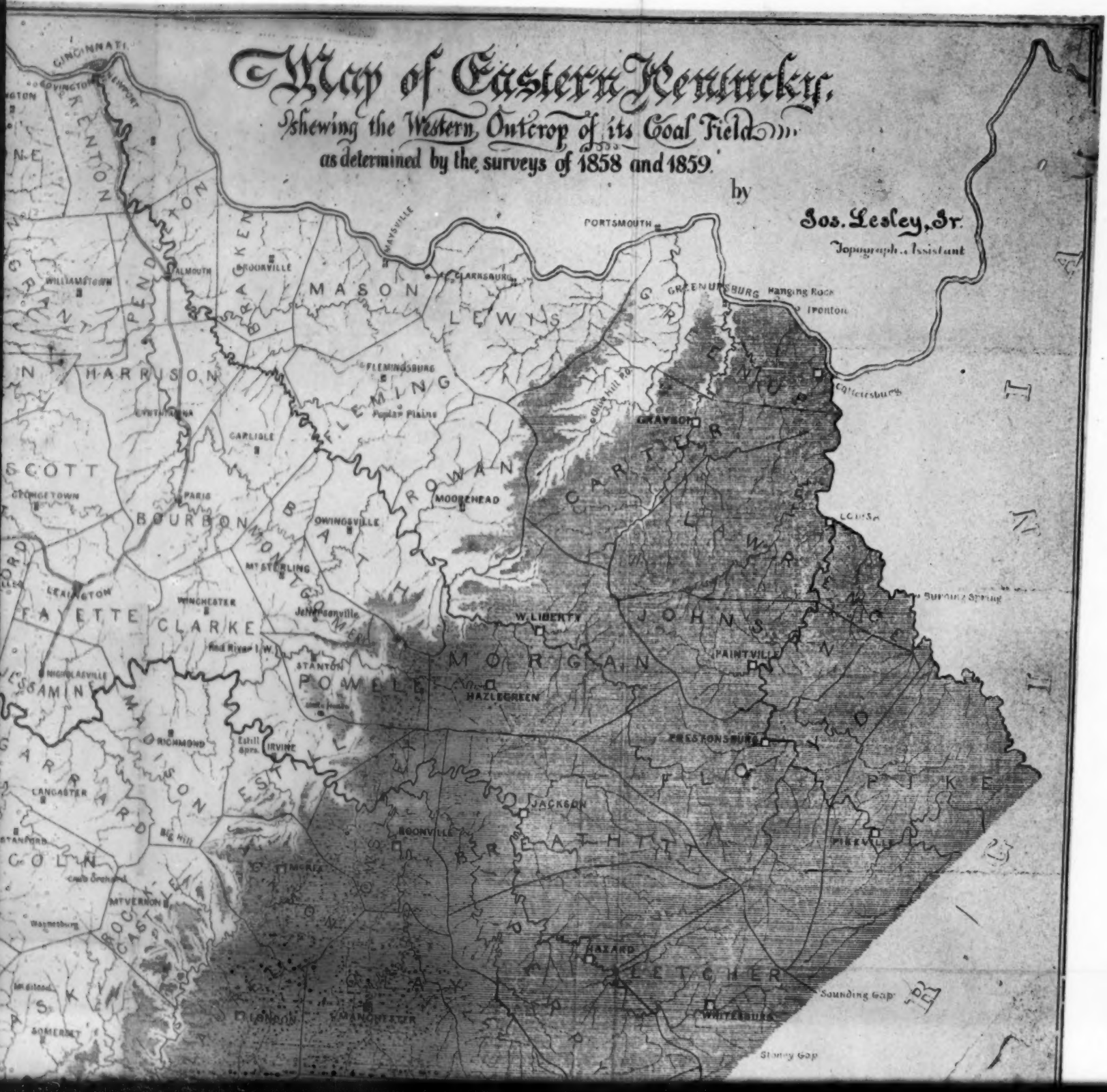
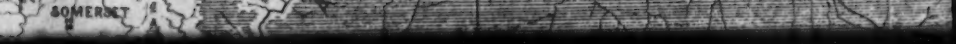
Correction.

For No. 90, page 255, 5th line from bottom, for "under" read "upper."


BURLINGTON
BOONE
WARSAW
GALLATIN
GRANT
OWENTON
OWEN
SCOTT
GEORGETOWN
FRANKFORT
LAWRENCEBURG
VERSAILLES
WOODFORD
MERCER
HARRODSBURG
DANVILLE
BOYLE
LINCOLN
STANFORD
LIBERTY
CASEY
SOMERSET

Map of Eastern
Shewing the Western Outcrop of its
as determined by the surveys of 1858
CINCINNATI
COVINGTON
NEWPORT
KENTON
WILLIAMSTOWN
ALMOUTH
BROOKVILLE
MAYSVILLE
CLARKSBURG
PORTSMO
MASON
LEWIS
FLEMINGSBURG
Poplar Plains
HARRISON
CYNTHIANA
GARLISLE
FLEMING
ROWAN
MOREHEAD
COTT
GEORGETOWN
PARIS
BOURBON
OWINGSVILLE
BATH
MONTGOMERY
Mt STERLING
LEXINGTON
WINCHESTER
Jeffersonville
W. LIBERTY
FAYETTE
CLARKE
Red River I.W.
STANTON
POWELL
MORGAN
NICHOLASVILLE
HAZLEGREEN
RICHMOND
Estill Spgs.
IRVINE
LANCASTER
Big Hill
JACKSON
BOONVILLE
BREATHITT
MCKEE
Crab Orchard
Mt VERNON
Waynesburg
LONDON
MANCHESTER
SOMERSET


Map of Eastern Kentucky,
Shewing the Western Outcrop of its Coal Field
as determined by the surveys of 1858 and 1859.
by
Jos. Lesley, Jr.
Topographical Assistant
CINCINNATI
COVINGTON
NEWPORT
KENTON
GRANT
PENDLETON
HARRISON
WILLIAMSTOWN
FALMOUTH
BROOKVILLE
MASON
MAYSVILLE
PORTSMOUTH
CLARKSBURG
LEWIS
GREENUPSBURG
Hanging Rock
Ironton
FLEMINGSBURG
Poplar Plains
Cliff Hill P.O.
Catlettsburg
GRAYSON
CARTER
LAWRENCE
LOUISA
Summit Spring
CYNTHIANA
CARLISLE
SCOTT
GEORGETOWN
PARIS
BOURBON
BATH
ROWAN
MOOREHEAD
OWINGSVILLE
MONTGOMERY
MT STERLING
LEXINGTON
WINCHESTER
FAYETTE
CLARKE
Jeffersonville
W. LIBERTY
JOHNSON
MORGAN
PAINTSVILLE
NICHOLASVILLE
STANTON
POWELL
HAZLEGREEN
BOURBON
Estill Spgs.
IRVINE
RICHMOND
PRESTONSBURG
FLOYD
PIKE
LANCASTER
GARRARD
MADISON
ESTILL
JACKSON
BREATHITT
BIG HILL
BOONVILLE
PIKEVILLE
COLYER
MT VERNON
Walnut Grove
Mt Gilead
CLAY
OWSLEY
LEE
KNOX
MANCHESTER
HAZARD
LETCHER
Sounding Gap
WHITESBURG
Stony Gap
SOMERSET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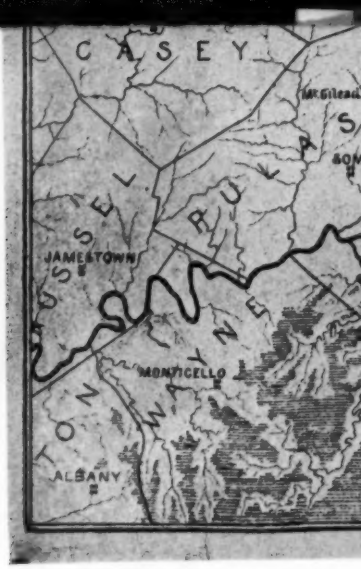
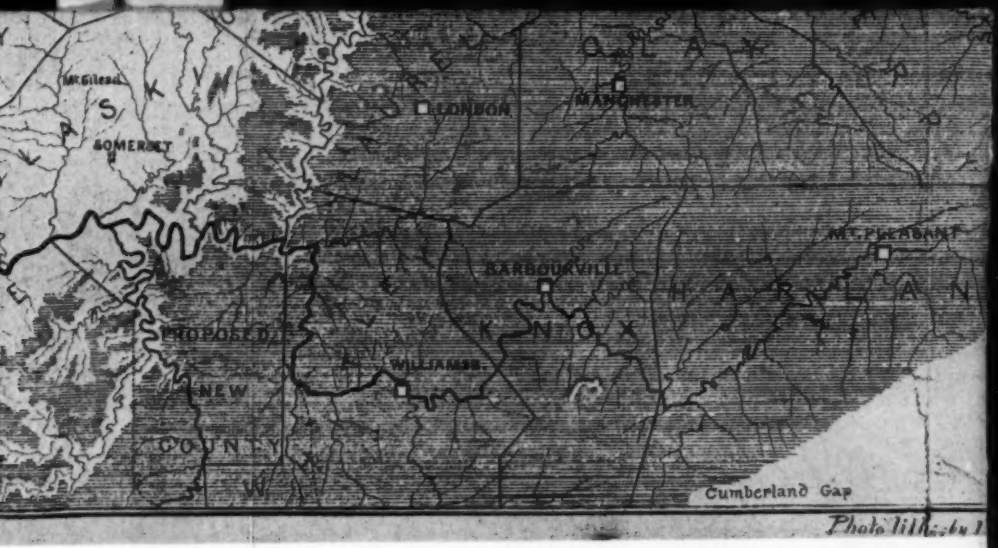

CASEY
JAMESTOWN
MONTICELLO
ALBANY


Mt. Gilead
SOMERSET
LONDON
MANCHESTER
MT. PLEASANT
HARBOURVILLE
PROSPECT
WILLIAMSB.
NEW
COUNTY
Cumberland Gap

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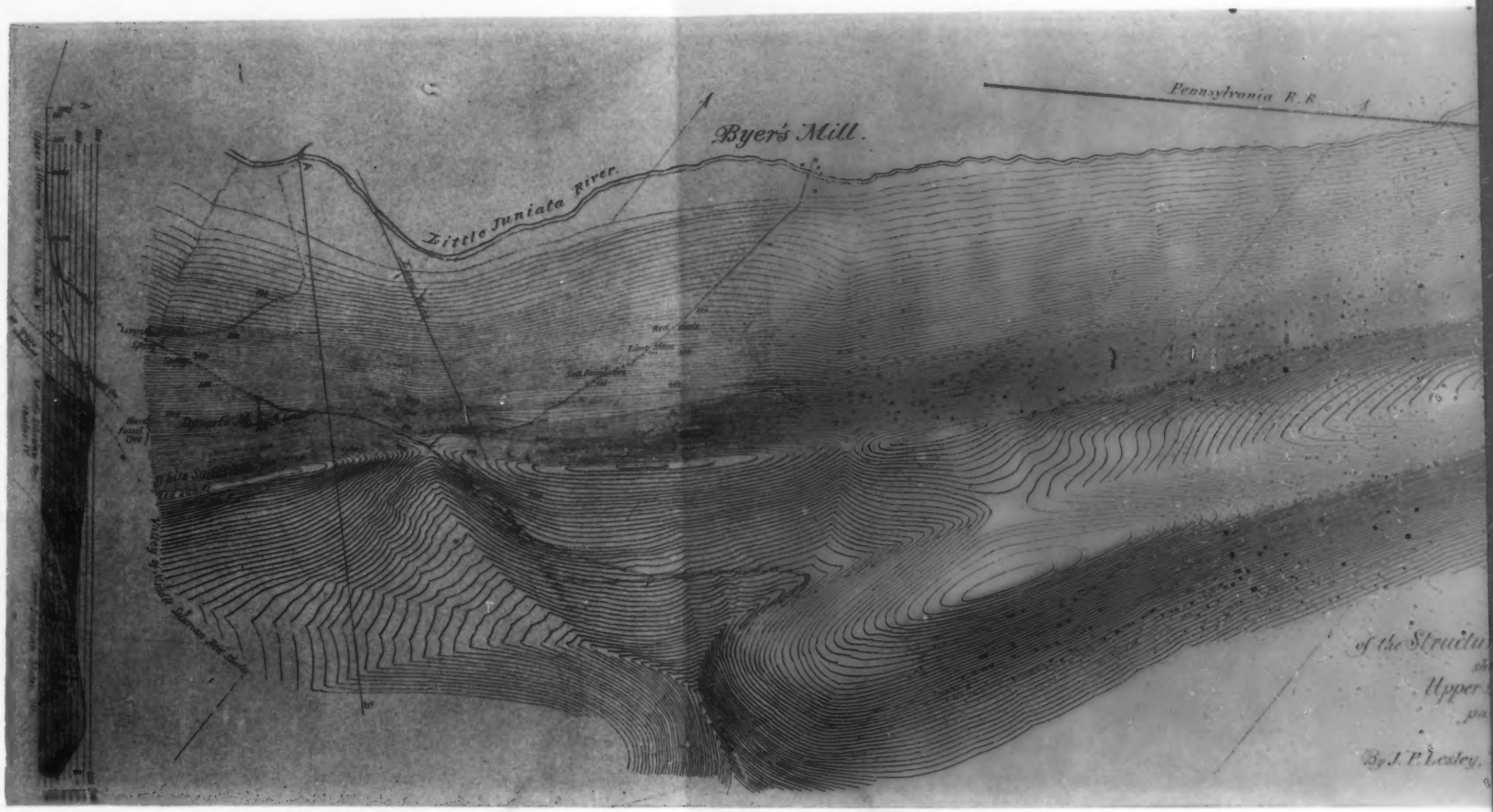
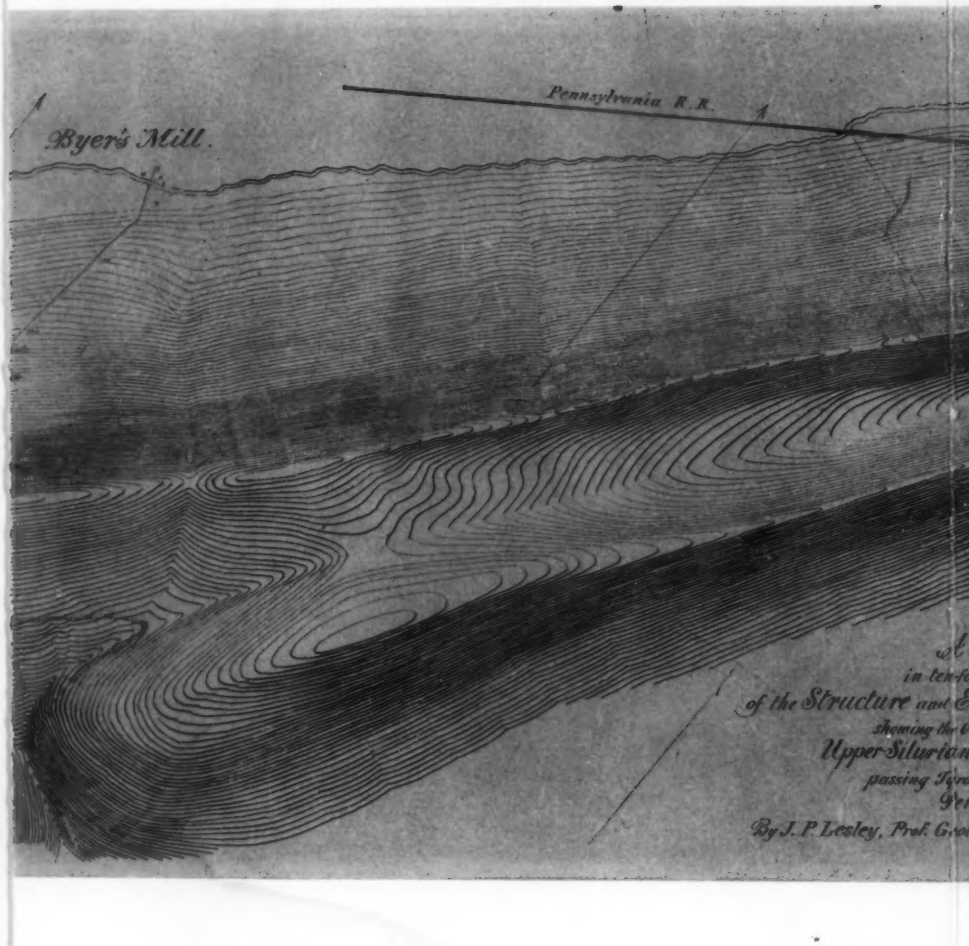
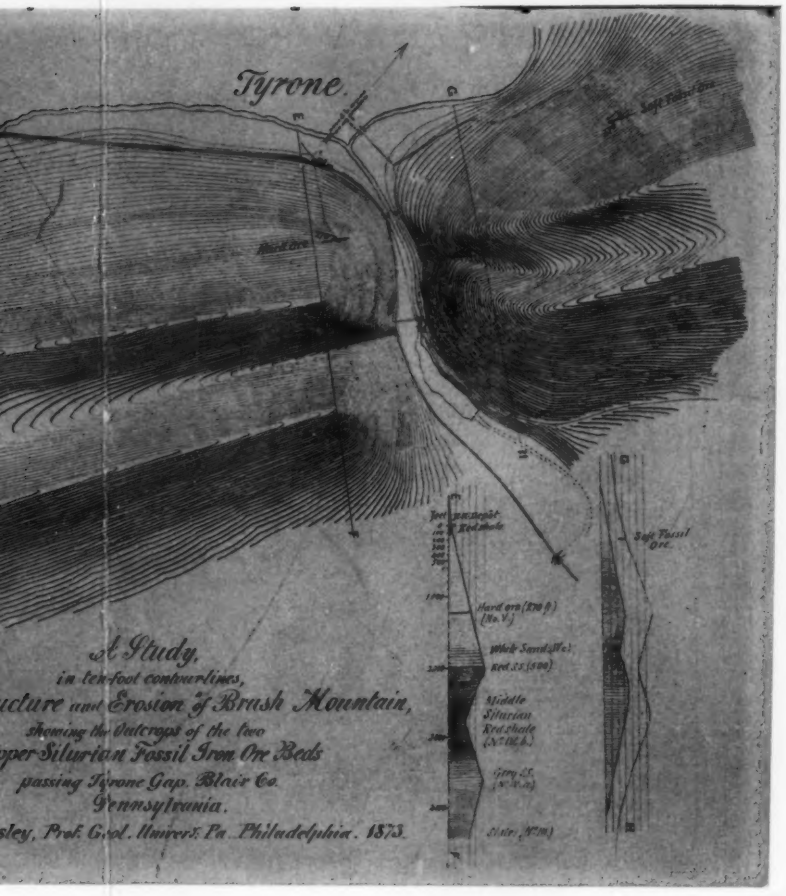
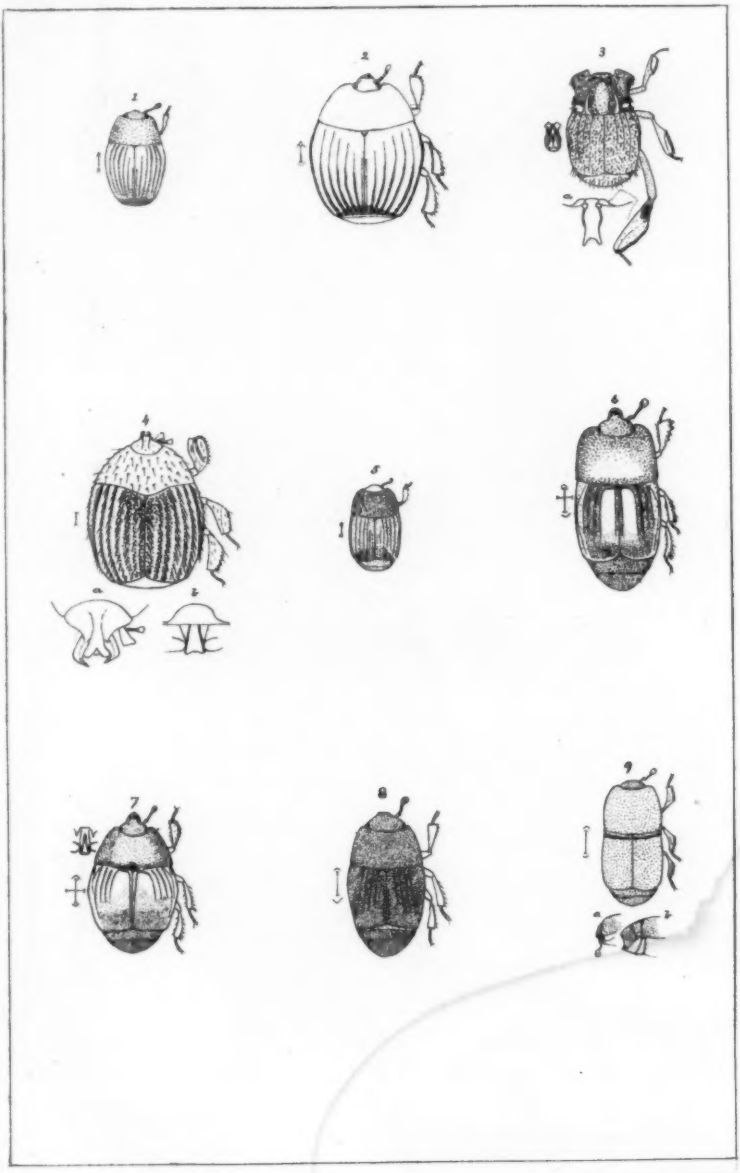

Pennsylvania R. R.
Byer's Mill.
Little Juniata River.
Red Shale
Lime Stone
Sub Fossiliferous Lime
Hard Fossil Ore
White Sandstone
Red Shale & Slate Stone
of the Struct
Upper
By J. P. Lesley.


Pennsylvania R.R.
Byer's Mill.
of the Structure and
Upper-Silurian
By J. P. Lesley, Prof. Geo



A Study,
in ten-foot contourlines,
ucture and Erosion of Brush Mountain,
showing the Outcrops of the two
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passing Tyrone Gap, Blair Co.
Pennsylvania.
sley, Prof. Geol. Univers. Pa. Philadelphia. 1873.